

Vol. XXII

No. 3

DISSERTATION ABSTRACTS

*ABSTRACTS OF DISSERTATIONS AND
MONOGRAPHS IN MICROFORM*

UNIVERSITY MICROFILMS, INC.
ANN ARBOR, MICHIGAN: 1961



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AGRICULTURE

AGRICULTURE, GENERAL

EVALUATION OF CERTAIN MORPHOLOGICAL AND CHEMICAL CHARACTERISTICS IN RELATION TO PALATABILITY IN REED CANARY GRASS (PHALARIS ARUNDINACEA L.).

(Order No. Mic 61-2462)

John Adrian Murray Brown, Ph.D.
Purdue University, 1961

Major Professor: Robert C. Pickett

Forty plants selected from a breeding nursery of Phalaris arundinacea L. were established in replicated four foot by eight foot sward plots. Seven plants having more than 28 chromosomes were winter-killed. Variation in morphological and certain chemical characteristics was studied in the remaining plants in conjunction with grazing experiments to measure relative palatability.

A red root-tip occurring in nine genotypes was noted. Forty-two selfed progeny from a plant having this character segregated 33 red to 9 white root-tips.

Variation among genotypes in all tiller characteristics studied was highly significant. Heritability estimates for vigor fluctuated widely between regrowths. There was no linear parent-progeny correlation for vigor. Selfed progeny had a marked reduction in vigor and height.

The linear correlation between mid-parent mean height and offspring family mean height for sixteen crosses was not significant. Several crosses resulted in heterosis for height. Genotypes varied in the extent of self-fertility; however, the seed set under selfing was much lower than the amount set in controlled crosses.

Tiller density increased in the first regrowth compared to the spring growth. A negative linear correlation was indicated between the logarithms of tiller density and tiller weight.

A 24 hour grazing with ten sheep per replication on 1958 second regrowth indicated significant variation in percentage loss of leaf between genotypes. In 60 hour grazing trials in 1959, percentage loss in tiller weight varied from zero to 78.9% among genotypes in two replications of first regrowth, and from 22% to 72% in four replications of second regrowth.

Certain genotypes were consistently unpalatable, and others very palatable in all three experiments. The 1960 first regrowth was grazed and the percentage loss in height computed.

The results confirmed the previous ranking of extreme genotypes. Visual estimates of percentage defoliation were effective only in detecting the least palatable genotypes.

Percentage loss estimated from weights of a unit number of tillers sampled before and after grazing satisfactorily estimated relative palatability. Coefficients of variation ranged from 13.2% to 23.4% and were lower than those of previous studies.

Progeny first regrowth showed no observable variation in palatability. All plots appeared intensively grazed after a 60 hour period with 65 sheep given access to 80 plots. The cross between the least palatable and most palatable genotypes produced all palatable progeny.

It was concluded that palatability was either an additively inherited characteristic or that unpalatability was due to a recessive genetic effect.

Grazing loss from second regrowth was approximately half that of first regrowth. The amount left was approximately the same, though the second regrowth tiller weights were less than those of first regrowth.

It was postulated that the palatability of forage in the second regrowth was lower than in first regrowth.

No morphological characteristic studied was closely associated with relative palatability. "Succulence," measured by the amount of juice expressed from a unit weight of leaves, was similar for very palatable and unpalatable genotypes.

The 1958 boot stage leaf showed higher water soluble phenolic concentrations in unpalatable genotypes compared with palatable genotypes. These values were lower in 1959 first regrowth leaves, but two of four unpalatable genotypes maintained higher values than palatable genotypes.

Proximate analysis of very palatable and unpalatable genotypes gave similar results. Lignin content was less than 2% in the leaves of all genotypes analyzed.

It was concluded that grazing trials are necessary to classify breeding material for palatability, and their relative palatability is strongly influenced by genotype.

Microfilm \$2.75; Xerox \$8.20. 180 pages.

THE MEASUREMENT OF HEATS OF REACTIONS OF SOIL COMPONENTS WITH A DIFFERENTIAL THERMAL ANALYSIS APPARATUS

(Order No. Mic 61-2688)

Boyd Gene Ellis, Ph.D.
Michigan State University, 1961

Major Professor: Max M. Mortland

The differential thermal analysis apparatus was used to measure heats of desorption of NH₃, methylamine, and ethylamine from clay minerals.

A theoretical discussion of the nature of heat flow within a differential thermal analysis sample holder was presented. The conclusions drawn from the theoretical discussion were related to the calibration curve of the heat of reaction versus area under the differential thermal curve made using nine different salts of known heats of inversion or fusion.

Two methods of determination of heats of reaction by

use of differential thermal analysis were compared. The heats of decomposition of magnesite and dehydroxylation of kaolinite determined by use of the Clausius-Clapeyron equation and the standard curve prepared by using pure salts deviated less than four per cent.

It was shown that the exothermic reaction observed upon release of NH₃ from bentonite clay is due to oxidation of the NH₃ catalyzed by the platinum thermocouples. A method was perfected using nitrogen gas to eliminate oxidation during analysis. Losses of both water and NH₃, methylamine, or ethylamine occurred between 200 and 550 degrees centigrade. It was postulated that the water loss between 200 and 450 degrees centigrade evolves from decomposition of Al(OH)₃. The average heat of desorption for the simultaneous loss of one mole of NH₃ and one mole of water between the temperatures of 200 and 450 degrees centigrade was 35.3 kilocalories. The average heat of desorption for methylamine under similar conditions was found to be 40.9 kilocalories. The desorption of ethylamine was accompanied by losses of large quantities of water; consequently, no heats of desorption could be directly connected with loss of ethylamine.

Studies conducted with formic acid, acetic acid, methanol, and ethanol saturated bentonite indicated that small quantities are retained by the bentonite, but that the bonding energies are not measurable by differential thermal analysis.

Accurate quantitative studies were not possible with the vermiculite used because the thermal properties of the sample changed upon heating.

It was shown that the method of eliminating oxidation with nitrogen gas during differential thermal analysis could be applied to soils high in organic matter yielding differential thermal analyses curves characteristic of the mineral components of the soils.

Microfilm \$2.75; Xerox \$5.20. 101 pages.

FORMULA FEED OPERATORS' PERCEPTION OF THE KANSAS AGRICULTURAL EXTENSION SERVICE

(Order No. 61-2954)

Paul W. Griffith, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Robert C. Clark

The over-all purpose of this study was to determine the perception of the Kansas Agricultural Extension Service program and personnel as held by a representative sample of formula feed dealers, mixers, and manufacturers operating within the state. The study also examined the relationships between the independent variables of Extension involvement, education, size of enterprise, years in business and age, and the dependent variable of the formula feed operators' perception of Extension.

The fourteen elements of areas of perception which were statistically tested for significant association with the five independent variables included: Understanding of Extension's purpose; function of providing information on specific problems; function of teaching principles of farming; Extension's responsibility to town and village families;

Extension's responsibility to urban and city families; county agricultural agent's activity of providing information directly to farmers; county agricultural agent's activity of training leaders; the county agricultural agent's job; program area of efficiency in agricultural production; program area of marketing; specialization needed by county agricultural agents; opinion on adequacy of county Extension staff size; appraisal of Extension's value to farmers; and opinion on frequency of county agricultural agent's help to farmers.

Two counties in each of the five Extension districts were randomly selected and every feed operator (total 116) in each county was interviewed personally by the author.

The data were classified and studied under four major headings: Perception of Extension's rôle, evaluation of Extension programs and staff, appraisal of Extension's value, and relationships between perception and independent variables.

Summary

The hypothesis that Extension involvement is associated with the formula feed operators' perception of the Kansas Agricultural Extension Service was accepted for only one of the elements of perception, namely, opinion on adequacy of county Extension staff size.

The hypothesis that education is associated with perception of Extension was accepted for two of the elements of perception, namely, perception of the county agricultural agent's job, and opinion on degree of specialization needed by county agricultural agents.

The hypothesis that size of enterprise is associated with perception of Extension was accepted for only one of the elements of perception, namely, the relative importance of the function of providing information on specific problems.

The hypotheses that years in business is associated with perception of Extension and that age is associated with perception of Extension was not accepted for any of the fourteen elements of perception statistically tested in this study.

The formula feed operators appeared to perceive the Extension Service as a service agency rather than as an educational institution. The respondents gave top ranking to: The purpose of providing farmers with specific answers to problems; the function of providing information on specific farm and home problems; and the activity of providing information directly to farmers.

The feed operators did not have a very clear perception of the organization, financing or staffing of the county Extension office. The respondents perceived that Extension had the greatest responsibility to families on average size farms. The program areas of farm and home management, training and developing leaders, and community and resource development were rated as needing more emphasis by more than one-half of the respondents.

The feed operators appeared to be satisfied with the processes of program determination and the qualification of county Extension agents. Nine out of ten respondents expressed opinions that county agricultural agents should be trained as generalists.

Boys and girls in 4-H Club work were ranked as receiving the most help from Extension with farmers ranking second. Nine out of ten respondents said the

county agricultural agents could always or usually help farmers with their problems if the farmers would contact the agents for help.

Microfilm \$2.85; Xerox \$9.90. 218 pages.

FACTORS AFFECTING THE VOLATILIZATION OF INSECTICIDES FROM SOILS

(Order No. 61-2956)

Charles Ronald Harris, Ph.D.
The University of Wisconsin, 1961

Supervisor: Assistant Professor E. P. Lichtenstein

In recent years factors influencing the persistence of insecticidal residues in the soil have received considerable attention. It has been established that some residues disappear more quickly than others, with the rate of disappearance apparently being dependent on the insecticide itself, the climate, and the soil type. Many insecticides are converted to either toxic or non-toxic metabolites in the soil. There is also evidence that many insecticides are lost from the soil by volatilization.

A study was begun in 1958 with three major objectives: first, to obtain evidence that volatilization of insecticide residues from the soil does occur; second, to determine the factors affecting the rate of volatilization; and third, to determine the quantitative importance of volatilization in the disappearance of insecticidal residues.

Two experimental procedures were devised: first, a fumigant time-mortality bioassay, using D. melanogaster (Meig.) and M. domestica (Linn.) as the test insects, was used for measuring the rate of volatilization of insecticide residues from soils; second, a quantitative chemical procedure was used for determination of the amounts of insecticide vapors volatilizing from soils.

Using bioassay procedures, both in the laboratory and in the field, it was found that aldrin, heptachlor, heptachlor epoxide, dieldrin, lindane, and phorate were volatile. In terms of rate of volatilization aldrin = heptachlor > heptachlor epoxide > dieldrin. It was also determined that the rate of insecticide volatilization increased in proportion to increasing concentrations of a given insecticide within the soil.

Bulk density (soil weight/volume) and air space porosity of the soil were found to have no effect on the rate of aldrin volatilization. However, aldrin was found to be strongly adsorbed to dry soils. The rate of volatilization decreased with increasing surface area of the soil particles. Addition of moisture to a soil resulted in a striking increase in the rate of aldrin volatilization, which was found to be directly proportional to the amount of organic matter in the soil.

In further experiments, it was found that both soil moisture and relative humidity of air passing over the soil influenced the volatilization rate. Aldrin volatilized 55 times as rapidly from a soil at field moisture capacity as compared to an oven dry soil. With increasing air humidity, aldrin was found to volatilize more rapidly.

Increasing air movement over insecticide treated soils resulted in an increasing rate of insecticide volatilization from the soil.

The volatilization rate was also found to be directly proportional to the temperature of the soil: increasing amounts of insecticide volatilized with increasing soil temperatures.

The quantitative importance of volatilization in the disappearance of an insecticide residue was measured by chemical analysis of vapors emanating from the soil. Aldrin was found to be relatively volatile, dieldrin much less volatile and DDT non-volatile (according to the analytical methods used). It was found that immediately after treatment of the soil with insecticide, the rate of insecticide volatilization was rapid. However, after longer periods of time, the insecticide appeared to be bound to the soil, and volatilization decreased to a rate which varied with soil types. In tests conducted with three soil types over periods of five to seven days, it was possible to account for over 90 percent of the aldrin applied to the soil. During these periods aldrin volatilized from the soil to the extent of from 16 to 38 percent of the initial soil application.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

SOME RESPONSES OF INBRED LINES OF CORN, ZEA MAYS L., TO 2,2-DICHLOROPROPIONIC ACID.

(Order No. 61-2960)

Henry Richard Keyser, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor K. P. Buchholtz

The response of 20 inbred lines of corn to foliar applications of sodium 2,2-dichloropropionate were studied. Marked variations in susceptibility were observed. Five inbreds considered to be resistant to the herbicide were W-187R, C103, W-41A, W-64A, and W-153R; W-A374B and W-22R were the most susceptible. No correlation was found between the relative maturity of the inbreds and either susceptibility or tolerance to the herbicide.

The responses of 20 inbred lines of corn to soil applications of sodium 2,2-dichloropropionate were studied. Marked differences in the responses among the inbreds were found. Inbreds Hy, W-182B, A, and W-Q85 were the most tolerant and W-22R, W-187R, and W-41A were the most susceptible. Fresh weights and heights of the inbreds were reduced by the soil applications of the herbicide.

Corn inbreds were more susceptible to foliar applications of sodium 2,2-dichloropropionate when in the 9-leaf stage of growth than in the 3- or 6- leaf stages of growth.

Inbred W-187R was not injured by foliar applications of various formulations of 2,2-dichloropropionic acid. W-A374B was susceptible to these materials. The sodium salt of 2,2-dichloropropionic acid and the sodium salt of 2,2-dichloropropionic acid with wetting agent were the most injurious. The ester of 2,2-dichloropropionic acid did not cause injury to either of the inbreds. Inbred W-187R was much more tolerant to foliar applications of chlorinated aliphatic acids than was W-A374B. The sodium salts of 2,3-dichloroisobutyric acid were the most injurious, while the sodium salts of 2,2,3-trichloropropionic acid and trichloroacetic acid were the least injurious.

At low light intensities the effects of soil applications of sodium 2,2-dichloropropionate on fresh weights and heights of corn inbreds were not as severe as at the medium and high light intensities.

The degree of tolerance of resistant inbreds was not affected by inclusion of a 1% surface-active agent in the spray solution. There was no difference in the wax content of the leaves of the resistant and susceptible inbreds. Sodium 2,2-dichloropropionate had no effect on wax evolution of leaves of the inbreds.

Variations in responses among corn inbreds to foliar applications of sodium 2,2-dichloropropionate appear to be due to physiological factors or to internal mechanisms rather than to differential wetting of the spray solution or to characteristics of the leaf surface.

The expression of the effects of sodium 2,2-dichloropropionate on corn inbreds is dependent on the method of application of the herbicide. Inbreds that proved to be resistant or susceptible to foliar applications of the herbicide did not respond in a similar manner to soil applications.

Corn inbreds grown in sand treated with sodium 2,2-dichloropropionate exhibited greater injury than when the inbreds were grown in soil. The effects of soil applications of the herbicide on corn inbreds grown at high temperatures were less severe than when the inbreds were grown at lower temperatures.

Wide variations in the responses of corn inbreds to soil applications of sodium 2,2-dichloropropionate may be due to differential uptake of the herbicide, to differential movement of the herbicide to the aerial portions of the plants or to differences among inbreds in eliminating the herbicide by excretion from the roots.

Calcium pantothenate solutions of 0.02 M applied to cut surfaces of leaves partially overcame the toxic effects of sodium 2,2-dichloropropionate on corn.

Variations among corn inbreds to foliar applications of sodium 2,2-dichloropropionate is probably due to physiological differences which are genetically controlled. The character(s) for resistance to the herbicide may be inherited and is (are) dominant.

Microfilm \$2.75; Xerox \$7.20. 151 pages.

**THE EFFECTS OF INVOLVEMENT ON THE
PARTICIPANTS IN COOPERATIVE
EXTENSION PROGRAM PLANNING IN
WAUPACA COUNTY, WISCONSIN.**

(Order No. 61-2962)

Micajah Pennington Lacy, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Gale VandeBerg

Purpose

The purposes of this study were to determine the effectiveness of involvement in the Cooperative Extension long-time program planning process in changing committee members' attitudes and knowledge and to identify personal characteristics of committee members that may be associated with their active participation in program planning. The specific objectives were three: (1) to explore the re-

lationship between committee members' participation in program planning and the variables of age, education, occupation, Extension involvement, participation in other organizations, attitude toward Extension, and knowledge of the Extension Service, (2) to determine if involvement in the long-time program planning process caused a change in committee members' attitudes toward the Extension Service, knowledge of the Extension Service and its activities, and knowledge of the county situation, and (3) to determine if the participant's degree of participation in program planning was related to change in attitudes toward the Extension Service, change in knowledge of the county situation, and degree of satisfaction derived from involvement in program planning.

Procedure

The subjects of this study consisted of the twenty-eight program planning committee members involved in long-time Extension program planning in Waupaca County, Wisconsin and a control group of an equal number. Each member of the committee was personally interviewed twice—once before intensive involvement in program planning and once after involvement. The changes in committee members' attitudes and knowledge were compared to those of the control group—interviewed at approximately the same interval—to determine if observed changes were caused by involvement in program planning.

Observation during the meetings and transcriptions from tape recordings of all meetings were used as a basis for determining individual participation. Over-all participation ratings were based on a combination of quantity and quality of contributions and observed performance of the participants in the group situation.

Summary of Findings

Age, education, Extension involvement, participation in other organizations, attitude toward Extension, and knowledge of the Extension Service appeared to be directly related to program planning committee members' degree of participation. There was no apparent relationship between occupation and degree of participation.

No changes in program planning committee members' attitudes toward the Extension Service, knowledge of Extension or knowledge of the county situation could be attributed to involvement in program planning when compared to the control group. Committee members indicated, however, that they were proud to have been selected to serve on the committee, were willing to serve on a similar committee, and were willing to spend more time on committee work. They also expressed more inclination to call on Extension for help on problems and more willingness to help Extension agents with future Extension programs.

Changes in attitudes, changes in knowledge, and satisfaction derived from involvement in program planning were not directly related to degree of participation of committee members. Low participators changed as much or more in a positive direction, so far as attitudes and knowledge were concerned, and expressed just as much satisfaction from the program planning experience as high participators.

Microfilm \$2.75; Xerox \$6.80. 144 pages.

AGRICULTURE, ANIMAL CULTURE**SOME EFFECTS OF INTRAMUSCULAR INJECTIONS OF TESTOSTERONE PROPIONATE ON THE GROSS CHEMICAL COMPOSITION OF MILK**

(Order No. Mic 61-2852)

Roy Joe Stuckey, Ph.D.
The Ohio State University, 1961

In an experiment designed to show some of the effects of intramuscular injections of testosterone propionate on the gross chemical constitution of milk, five cows were injected every four days with five milligrams of testosterone propionate per each hundred pounds of body weight.

The chemical constituency of the milk was compared during the treated periods with that which was produced during the ten-day periods immediately prior to the injections.

No changes in milk constituency could be associated with the treatments at this level.

A few weeks later, four cows were injected with ten milligrams every seventy-two hours.

At this level all four cows experienced very violent and sustained heat periods and produced milk in their treated periods that contained slightly less protein, slightly more fat, slightly more total solids and approximately 108 per cent more carbohydrates and ash, a figure which approached significance at the 5 per cent level of probability.

Microfilm \$2.75; Xerox \$4.60. 86 pages.

NUTRITIONAL STUDIES ON RANCH-RAISED MINK

(Order No. Mic 61-2718)

Hugh Farrant Travis, Ph.D.
Michigan State University, 1961

Major Professor: Philip J. Schaible

Investigations on ranch-raised mink were conducted at M.S.U. over a five-year period: (1) to evaluate diets containing no fresh animal products; (2) to determine requirements for various nutrients using semipurified rations; and (3) to study any possible effects of certain antibiotics and hormones during the reproductive cycle.

Dry diets containing no fresh animal products, or supplemented with fresh liver or tripe, were fed through two growth and two reproduction periods. Total weight gains of the mink on dry diets were less than those of the mink on the ranch ration. Mink on dry diets grew more slowly than the controls during the period from 11 weeks to 16 weeks of age. However, from 16 weeks to 29 weeks the growth of the mink on dry diets was more rapid. Growth response of mink receiving the dry diet supplemented with 25 percent fresh liver was intermediate between mink receiving the ranch ration and those receiving the dry diet. Fur quality and length of the live mink were as good on the dry diets as on ranch rations.

Increasing the fat level in the dry rations from 12 to 20 percent improved the growth rate of kits. No beneficial

effect was apparent from further increasing the fat to 28 percent. Male mink showed a greater response to changes in diets than females.

Adult mink fed dry diets prior to breeding and then dry diets with fresh liver during periods of breeding, gestation and lactation, were comparable in weight, breeding performance and number of kits whelped per female to mink fed a typical commercial ranch ration. However, 21-day kit weights of the controls were greater. The response from adding fresh liver or from adding fresh tripe to dry diets during lactation and early kit growth was similar. This indicates that perhaps the value of the fresh animal products may be due to palatability rather than the nutrient values it contributed.

Semi-purified diets were used to ascertain if adult mink require dietary vitamin K, whether dark mink differ in this respect from sapphire mink, and if the feeding of sulfa-quinoxaline or certain antibiotics affect blood clotting time. The dietary requirement of vitamin K for normal adult mink was found to be less than 13 milligrams of menadione sodium bisulfite per ton of feed. Sulfaquinoxaline fed for six to eight days at 0.5 percent or higher, significantly increased whole blood prothrombin clotting time, while addition of aureomycin or terramycin at levels of 400 grams per ton of food did not.

Experiments were conducted during two growing seasons to determine the protein and amino acid requirements for growing mink. Depletion-repletion and growth study techniques were applied with partial success. Growing mink maintained their weights for short periods of time on semipurified diets containing 15 percent protein and 20 percent fat when supplemented with appropriate amino acids.

Terramycin was fed at 400 grams per ton of feed during two lactation and early kit growth seasons. There was no beneficial effect in kit production, growth or mortality that could be attributed to the antibiotic treatment. Kit weights at 21 days from mothers receiving the antibiotics were significantly smaller than those of the controls during one year's study.

Thyroprotein containing one percent thyroactive iodinated casein was fed to pregnant females at levels of 0.53 milligrams per 100 grams of body weight, starting five days before the first litter was to be expected and continuing until the young were two weeks old. There was no effect on number of kits born or incidence of mortality of the young. Kits from treated mothers were significantly smaller at 14 days of age.

Diethylstilbestrol was fed intermittently to bred females, starting after implantation and continuing through late gestation, whelping and early kit growth. Results were almost complete failure of reproductive processes, and resulted in reabsorption, lowered kit production and kit weights, as well as greater kit mortality.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

THE VALUE OF PART LACTATION RECORDS IN SELECTION

(Order No. Mic 61-1423)

Lloyd Dale VanVleck, Ph.D.
Cornell University, 1960

Ratio factors for adjusting monthly records for age at calving and season of calving effects, for extending single monthly records to a ten month basis, and for extending cumulative monthly records are derived from 177,575 monthly records of Holstein cows. Analysis showed that ratio factors for these purposes should be developed while simultaneously considering age, season, stage of lactation, and whether the record is milk or fat production.

Regression equations for predicting total yield of milk on a within herd basis from monthly records, linear functions of sequential monthly records, cumulative monthly records, linear functions of bimonthly and trimonthly records, and cumulative bimonthly and trimonthly records are presented. The multiple correlation between a linear function of the first seven monthly records and total yield is 0.96. The high accuracy of bimonthly testing strongly suggests the possibility of testing at two month intervals rather than once a month.

Prediction equations for estimating on a within herd basis the succeeding lactation yield from monthly records, linear functions of sequential monthly records, cumulative monthly records, linear functions of bimonthly and trimonthly records, and cumulative bimonthly and trimonthly records are presented. The correlation of the fifth monthly test record with the next complete record is 0.50 as compared to the correlation of successive total yields which is 0.55. A linear function of the first five monthly records is equally as accurate as total yield in predicting the next complete record. Multiple regression equations using more than the first five monthly records are slightly more accurate. The correlation between linear functions of bimonthly records and succeeding total yield is 0.57. Cumulative bimonthly records are almost as accurate as total yield in predicting the next lactation yield.

Repeatability estimates are obtained from a within herd regression of the succeeding record on the first available record for monthly records, cumulative monthly production, cumulative bimonthly and trimonthly records, and linear functions of sequential monthly records and of bimonthly and trimonthly records which are used to predict total yield. The estimated repeatabilities of monthly records increased with stage of lactation until the sixth month and then declined. The values for cumulative monthly records and for linear functions of sequential monthly records increased steadily with an advance in lactation reaching a plateau at about the seventh month. Bimonthly and trimonthly records are slightly less repeatable than total yield. The repeatability of total yield is estimated as 0.53.

Heritability estimates are obtained from paternal half-sib analyses of the same functions for which repeatabilities were estimated. The estimates followed patterns similar to those for repeatability except that peak heritability of monthly records occurred earlier in the lactation and that the plateau of heritability of cumulative production also occurred earlier. Heritability of total milk yield, 0.23, was estimated to be greater than heritability of monthly records.

Estimates of genetic correlations of monthly yield and

cumulative monthly yield with total milk yield followed the same pattern as repeatability estimates. The genetic relation between months was near unity for adjacent months and declined as the length of time between monthly records increased. The estimates of genetic correlation between total yield and bimonthly or trimonthly test results were approximately one.

Genetic progress for total yield by selection of A.I. sires based on bimonthly testing or on seven or eight month data would be almost as rapid as selection based on monthly testing for ten months. Relative progress for bimonthly testing varied between 0.91 and 1.04.

A method is developed to determine the number of sets of functions of monthly records required to estimate a sire's breeding value for total yield as accurately as a fixed number of complete records.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

AGRICULTURE, FORESTRY AND WILDLIFE

THE SPRUCE-FIR FORESTS OF THE COAST OF MAINE

(Order No. Mic 61-1088)

Ronald Barnard Davis, Ph.D.
Cornell University, 1961

This study is a detailed description and analysis of spruce-fir forests at their southern non-montane limit in eastern North America. The percentages of spruce and fir in the forests were mapped by aerial reconnaissance. Small spruce-fir areas were found as far southwest as Kittery, on southward-facing coastal irregularities. From Casco Bay to Rockland, and from the islands of Penobscot Bay to Columbia Falls, the percentage crown cover by spruce and fir is usually greater than 50% near the coast and diminishes inland. From Columbia Falls eastward and northward coastal spruce-fir areas merge with the more extensive inland spruce-fir-northern hardwoods forests. East of Sheepscot Bay *Picea glauca* forms a distinct sea-side border, with *P. rubens* usually attaining dominance just landward.

Cool and fog-laden sea winds cause a distinctly maritime climate during the growing season. By multiple regression analysis the percentage spruce and fir (Y) in the coastal forests was found to be strongly correlated with the independent variables marine exposure (X) and latitude (Z). When a map of spruce and fir percentages based on the regression formula-derived constants was charted, it corresponded closely to the real forest distribution. Factors held in common by marine exposure and latitude, especially a cool growing season coupled with adequate moisture supply, are proposed as major factors controlling the distribution of spruce-fir forests on the Maine coast.

Literature pertaining to the history of the coastal forests since the most recent glaciation is reviewed. Forest descriptions by early European explorers (ca. 1600 A.D.) suggest forest distribution patterns similar to those in 1959. These descriptions suggest that the forests were strongly affected by fire, probably in part from the activities of

aboriginal peoples. Direction of fire movement controlled by the winds would tend to reinforce the contemporary configuration of spruce-fir distribution.

Selected plant and animal populations of seventeen "mature" relatively undisturbed spruce-fir stands distributed from Kittery to Cutler were sampled by quadrats, transects, and other methods. Extensive tabulations of vegetational quantities, flora, and fauna are presented. Adequate reproduction by spruce and fir, in addition to other evidence, suggests climax status of spruce-fir stands at many coastal sites. Tree ring analysis and other data reveal late successional trends toward dominance by *Picea rubens*. Age class structure of even-aged second growth stands begins to break down at about 75 years of age, gradually transforming to a multi-aged structure with greatest numbers of individuals in smallest size classes. *Abies balsamia* populates small openings. *P. glauca* plays a distinctive role along the immediate shore where it populates blowdowns and other relatively extensive openings. *P. glauca* dies off during prolonged closed forest conditions which favor dominance by *P. rubens*.

Coastal Maine spruce-fir stands are characterized by the following herbaceous species: *Maianthemum canadense*, *Trientalis borealis*, *Coptis groenlandica*, *Cornus canadensis*, and *Aralia nudicaulis*. Bryophytes cover about 33% of the ground, and are dominated by *Calliergonella schreberi*, *Bazzania trilobata*, *Ptilidium* spp., *Hylocomium splendens*, and *Dicranum rugosum*. Shrubs contribute negligible cover. The most numerous breeding bird species in 1959 were: black-throated green warbler, golden-crowned kinglet, myrtle warbler, magnolia warbler, and blackburnian warbler. Data and analyses of macroclimate, microclimate, soils, trees, shrubs, corticolous flora, other vertebrates, and carabid beetles is presented also.

The biogeographic relations of the coastal Maine spruce-fir forests are discussed. The forests include strong representation by both Appalachian and boreal species. Dominance by *Picea rubens* is an Appalachian feature, while the seashore border of *P. glauca* and the presence of numerous northern species reflect boreal affinities. An outstanding binding feature in spruce-fir forests throughout eastern North America is the numerous widely distributed bryophyte species.

Microfilm \$4.20; Xerox \$14.85. 328 pages.

THE EFFECT OF FREEZING AND THAWING ON SOIL MOISTURE, BULK DENSITY, AND SHEAR STRENGTH UNDER OPEN AND FOREST CONDITIONS.

(Order No. Mic 61-2698)

Arthur William Krumbach, Jr., Ph.D.
Michigan State University, 1961

Major Professor: Donald P. White

Information is available on soil moisture contents and bulk density changes during freezing or thawing periods. However, information is needed on the soil moisture, bulk density, and shear strength regime during freezing and thawing periods, and their relation to soil, precipitation, and vegetative cover.

From November 1959 to May 1960 soil moisture, bulk density, and shear strength were studied in the upper 15 in. of two medium-textured soils in Kent and Clinton Counties, in the lower peninsula of Michigan. In each county three plots were established, one with hardwood cover, one with herbaceous cover, and one bare.

Texture, organic matter content, specific gravity, and Atterberg limits were determined for each soil. Depth, density, and water equivalent of snow and frost; frost type; soil moisture; bulk density; and shear strength were sampled periodically in 3-in. layers.

Daily air temperatures were similar in both counties but Kent County received more snow. During the period of continuous snow cover the Kent County Bare, Herbaceous, and Hardwood plots averaged 3.55, 1.21, and 1.23 in. more snow than the Clinton County plots. Prior to being covered with snow, bare plots in both counties contained more frost, and to a greater depth, than plots with vegetal cover. Amount and depth of frost were about equal in plots under similar cover.

Depth of freezing in Clinton County was correlated with air temperature during the eight-day period before a sample date. Depth of frost on the hardwood plot was about 3.5 times less than the herbaceous plot, and frost in the herbaceous plot about 2.2 times less than in the bare plot.

In Kent County depth of freezing was consistently less in the hardwood-covered plot than the other two plots.

Bulk density of each 3-in. depth was inversely related to frost depth in the 15-in. soil layer and to moisture content in the same 3-in. depth. The relation exists because there is a repetitive process of moisture moving into areas, freezing, expanding, and causing more free pore space.

Moisture continued to move from the snowpack through this pore space--even though concrete frost was present throughout the study period.

That moisture was constantly moving through the frozen soil helps explain why moisture could not be statistically correlated with frost depth. Also, moisture may exist in frozen soil in the vapor as well as liquid phase, and may or may not be present in frozen soil.

Shear strengths were below the prefreeze level while the soils were thawing. However, after soils thawed and moisture contents had dropped below prefreeze level, shear strengths remained unusually low for a period of time. This is ascribed to the coating of soil aggregates with a thick moisture film early in the thaw period.

Microfilm \$2.75; Xerox \$9.00. 196 pages.

AN ANALYSIS OF PULPWOOD MARKETING IN MICHIGAN

(Order No. Mic 61-2700)

Gordon Depew Lewis, Ph.D.
Michigan State University, 1961

Major Professor: Lee M. James

This study was made to determine the structure of the pulpwood market as it exists in Michigan, and to determine the purposes served by the various segments of the marketing chain. Special consideration is given to the pulpwood

transportation system and procedures, and to the potentialities of cooperative marketing as a method of making pulpwood production more attractive to the more stable producers.

Data were obtained by mail questionnaires in 1957 and 1959, and field interviews were conducted in the summer of 1959. In 1957, mail questionnaires were sent to all Lower Michigan pulp mills and to the railroads serving them to gather information pertaining to transportation methods and costs. In 1959, a second set of mail questionnaires was sent to Michigan and Wisconsin pulp mills to obtain data as to pulpwood consumption, prices, sources, and methods of procurement. In the summer of 1959, field interviews were conducted with the public landowners, pulpwood marketing cooperatives, and selected producers. These sources of primary data were supplemented with information from a number of secondary sources.

Michigan pulpwood, the major revenue-producing product of the forests of the state, is the chief raw material for the Michigan pulp and paper industry and constitutes almost one-fourth of the Wisconsin pulpwood consumption. This pulpwood is produced primarily by small, part-time producers dealing directly with the pulp mills. All production is carried out under contract; but is quite irregular, varying from 700,000 to 1,000,000 cords per year depending on pulp mill demand.

At present, the main source of pulpwood stumpage is the small private forest ownerships, but due to poor cutting practices in the past, there is a definite trend toward taking a greater proportion of the annual procurement from the public forest lands. There is a continuing steady decline in the pulpwood productiveness of the private woodlands.

No Michigan pulp mill is completely dependent on the pulpwood middleman, and, at present, only a limited number are using the services offered by the pulpwood dealers. As dealer services are dependent on the distance between the pulp mill and the wood supply, the present trend toward greater usage of the more common hardwoods and the over-supply of the other species tend to discourage the use of the dealer system. The greatest advantage of the use of the middleman is that the pulp companies may grant contracts of greater size to fewer individuals, thereby reducing the administrative costs. However, as the use of pulpwood dealers does not free the pulp companies from having to grant financial aid, many companies feel that the dealers do not fully serve their purposes.

All Michigan pulp mills grant aid to their suppliers. This aid is usually in the form of advance payments on wood which has been cut but not delivered. No pulp company provides funds for stumpage procurement, and few will purchase stumpage for their suppliers.

All pulp companies pay basically the same price for pulpwood, but they tend to compete with one another in non-price terms. The willingness to purchase pulpwood at points other than the mill woodyard and to assume the costs of transporting it to the mill permits the mills to compete for wood in the same areas without affecting the price while reducing the costs to the seller.

Pulpwood production is a profitable operation, but the extent of profitability varies greatly depending on the species, locations, and negotiating abilities of the producers. However, the long-term effect of the characteristic cutting practices on private lands is that the landowner may not be maximizing his long-run profits.

Microfilm \$3.75; Xerox \$13.30. 291 pages.

AGRICULTURE, PLANT CULTURE

EFFECT OF SALINE WATERS ON SOIL PROPERTIES AND PLANT NUTRITION IN KUWAIT

(Order No. 61-2916)

Mahmud Suleiman Sayyid Ahmad Abu Fakhr, Ph.D.
University of Arizona, 1961

Supervisor: W. H. Fuller

A field and pot culture study was undertaken in an attempt to determine the effect of saline solabeya water on soil salination, gatch formation and plant uptake of nutrients.

Three gatch and three sandy soil profile samples were used in this study. The soil samples were virgin profile 'A' samples from the Experimental Farm Extension, cultivated profile 'B' samples from the Experimental Farm and cultivated profile 'C' samples from Bid'a Nursery of the Education Department. The gatch samples were collected from sites 'A,' 'C' and plot No. 6, of the Experimental Farm Extension, Bid'a Nursery and Experimental Farm respectively.

Three indicator plants, Lettuce (*Lactuca sativa*, variety Great Lakes), green beans (*Phaseolus vulgaris*, variety Black Valentine), and Petunia (*Petunia hybrida*) were used.

The effect of soil texture, change in the reaction of the medium, concentration of solabeya saline water and soil solution on gatch formation were studied. A coarse sandy subsoil horizon high in silica constituted the proper medium for gatch formation. The major cementing agents were silica and the carbonates and hydroxides of calcium and magnesium. Alumina, iron oxide and gypsum play a minor role in cementation due to their low concentration. An increase in the alkaline reaction and concentration of the saline solution favored precipitation of potential cementing agents present as soluble constituents of the medium. The presence of gatch and use of solabeya saline water lead to the formation of saline perched local water table and soil salination.

Differential irrigation waters, representing various dilutions of solabeya saline water were used for irrigation of pot cultures. Differential increments of nutrient solutions, supplying nitrogen, phosphorus, potassium, calcium, magnesium, and sodium were applied to the respective treatments of the pot cultures.

The development, sequence of appearance, and severity of visual symptoms of general salinity effect showed direct correlation with salt sensitivity of the indicator plant and the degree of salinity of the medium. In all cases, the symptoms were earlier and more severe in bean, followed by lettuce and petunia.

As a result of cationic and anionic antagonism and an increase in the salinity of the medium, plant uptake of N, P, K, Fe and Mn was reduced, as revealed by the level of these elements in the leaves of the indicator plants, whereas the levels of Mg, Na, B, Cl, and SO₄ increased in the leaves of the indicator plants.

The application of differential increments of N, P, and K to the respective treatments of the indicator plant cultures resulted in a relative increase in the level of these elements in the leaves and a specific decrease in the level of the antagonistic elements. But, due to the effect of the

increase in salinity of the medium of the respective treatments, and decrease in yield of green weight, the level of these elements maintained a gradual specific decrease in the leaves. Microfilm \$2.75; Xerox \$8.80. 193 pages.

SOME PHYSIOLOGICAL RESPONSES
OF THE TOBACCO PLANT TO
GIBBERELLIC ACID

(Order No. Mic 61-2359)

Milford Slagen Brown, Ph.D.
The Pennsylvania State University, 1961

Several reports have indicated that the alkaloid metabolism of the tobacco plant is altered by the application of gibberellic acid. This thesis reports the results of experiments in which the effects of gibberellic acid were investigated further.

In the greenhouse, application of 10 µg. to 2 mg. of the compound caused a 30 per cent reduction of the alkaloid content of plants within a period of 1 to 10 weeks.

In the field, a decrease in alkaloid content results from gibberellic acid treatment only if the application is not made too late in the growing season. No change in alkaloid content was observed when gibberellic acid was applied at the rate of 5 mg. per plant 2 weeks before harvest. On the other hand, the effects of treatment early in the season are largely outgrown by harvest time. In one field experiment, the per cent ash was increased when gibberellic acid was applied at the rate of 8.5 mg. per plant, but protein and reducing sugar content and hygroscopicity were not altered.

In greenhouse experiments in which only a limited number of plants were used to study the rate of change of alkaloid content, small differences in alkaloid content were obscured by the large natural variation. For experiments of this type, use of plants of a single clone, rather than seedlings, would seem desirable.

The change of alkaloid content during curing was not modified by treating the plants with gibberellic acid before harvest.

Young tobacco plants were supplied with C¹⁴O₂ so that the incorporation of photosynthetically fixed carbon into alkaloids could be studied. The rate of incorporation was found to be very low. This suggests a low rate of alkaloid turnover within the plant.

The rate of alkaloid disappearance was studied in detached leaves kept in moist sand. The rate of alkaloid loss was greater in leaves from gibberellic acid treated plants than in those from untreated plants. The theory that gibberellic acid exerts its influence through interference with alkaloid synthesis does not explain the observations reported here. The rate of synthesis observed in C¹⁴O₂ uptake experiments does not appear to be great enough to permit the rapid turnover which such a theory would require. In detached leaves, which have very little synthetic capacity, there should be no difference in the rate of alkaloid disappearance between treated and control leaves. Since a difference was observed, it is necessary to conclude that gibberellic acid must cause an increased rate of alkaloid breakdown. The mechanism or mechanisms involved in the breakdown are not apparent at this time. In one series of field experiments, the nornicotine disappear-

ance exceeded the nicotine disappearance. On the other hand, chromatographic separations of greenhouse grown material indicated that GA did not cause a change in the relative amounts of the alkaloids.

Microfilm \$2.75; Xerox \$3.00. 43 pages.

SIB-COMPATIBILITY IN S₁ LINES
OF MEDICAGO SATIVA L.

(Order No. Mic 61-2262)

Ricardo Manzo Lantican, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Dr. C. P. Wilsie

A study was undertaken to consider the possibility of using advanced generations of inbred lines of alfalfa for commercial hybrid seed production. Using S₁ plants taken from one high, one intermediate, and two low self-fertility groups, a comparison of seed setting resulting from selfing, sib-mating and backcrossing was made.

The plants were grown under greenhouse conditions. Forty-two S₁ plants randomly obtained as cuttings from inbred populations and later grown in pots, constituted each of the four families studied.

Sib-mating was accomplished by making cyclic crosses among the S₁ plants, using ten flowers per cross. Four replicated series of sib-crosses were made. Backcrosses of each S₁ plant using the original non-inbred parental clone as pollen source also were made in four replicated series, utilizing ten flowers for each cross. Self-fertility of each S₁ and non-inbred plant was measured by selfing at least 300 flowers.

In making the crosses flowers were emasculated and pollen was applied immediately. Selfing was carried out by artificial tripping of the flowers. Fertility was measured on the basis of the number of seeds that set per flower selfed or crossed.

1. There was a marked reduction in self-fertility among the S₁ plants in all groups. Expressed as a percentage of the self-fertility of the non-inbred parental clone, the average self-fertility of the high, intermediate and two low self-fertility groups was 18.67%, 27.03%, 19.70% and 10.24%, respectively. There was a wide range in self-fertility within families in the first two groups.

2. There was a considerable gain in fertility following sib-mating over that of selfing in the high and intermediate fertility groups. Seed setting resulting from sibbing was 2.01 and 4.31 as much as that of selfing in the two respective groups. The gain in fertility obtained in the two low-fertility groups was considered insignificant, for practical purposes.

3. Analysis of variance in the sib-crosses made for the high and intermediate fertility groups showed statistical differences at the 1 per cent level in seed set among crosses and among cross combinations. There was a wide range of variation in seed setting among the sib-crosses and in some cases it reached the level of cross-fertility of two unrelated non-inbred clones. Also, in some instances reciprocal crosses differed significantly in fertility.

4. Results of backcrossing showed statistical differences at the 1 per cent level in cross-fertility among the

S₁ plants. There was a consistent increase in seed setting resulting from backcrossing over that of sib-mating in all the groups. Seed setting was even as high, if not higher, than that of the corresponding selfed non-inbred parental clone.

5. Statistically significant correlation values were obtained either at the 5 or 1 per cent level, except for one, between self-fertility and cross-fertility following sib-mating or backcrossing. The positive association was believed to have been brought about by the inherent differences among the *S₁* plants in the production of highly functional gametes, especially in the ovules.

Microfilm \$2.75; Xerox \$5.00. 97 pages.

THE RELATION OF MEASUREMENTS
OF QUALITY TO NUTRIENT-ELEMENT
CONTENT OF FOLIAGE OF ROUNDLEAF
JAPANESE HOLLY (Ilex crenata
"ROUNDLEAF") AND SOUTHERN
MAGNOLIA (Magnolia grandiflora)
PLANTS GROWN IN CONTAINERS

(Order No. Mic 61-2838)

Henry Porter Orr, Ph.D.
The Ohio State University, 1961

A photometer was designed, which was found to be a highly effective device for measuring the quality of Roundleaf Japanese Holly (Ilex crenata "Roundleaf") and Southern Magnolia (Magnolia grandiflora) plants. The light source consisted of a bank of 20-watt daylight fluorescent tubes spaced as closely as possible. The tubes were enclosed in a box painted white for maximum reflection. In front of the tubes was a pane of glass etched on both sides for maximum diffusion. The receiver unit consisted of a box approximately 4 inches in depth and 2 feet square. The interior was painted white. A pane of glass etched on one side was used with the etched side toward the light source to diffuse the light again and to prevent spot readings.

Measurement of the light intensity within the receiving unit was accomplished by using four sun batteries connected in series with a resistor and a microampere meter. The sun batteries were placed on the sides of the receiving unit, one in the center of each side. All faced the opposite side of the unit rather than the front (glass) or back. This arrangement made it possible to measure the average light intensity within the receiving unit.

Highly significant correlations existed between the photometer readings of Roundleaf Japanese Holly plants and the fresh weight of these plants and/or their square area. Similar highly significant correlations existed between the photometer readings of Southern Magnolia plants and their fresh weight and/or height.

When a standard grading system was used and compared with photometer readings, high correlations existed. As the grades decreased, the photometer readings increased (less light was excluded), and the density was determined to be less than that of a higher grade.

In factorially designed fertilizer experiments in a greenhouse at Auburn, Alabama, and in three commercial nurseries in the Semmes, Alabama, area, Roundleaf Japanese Holly plants were found to contain higher amounts of foliar

nitrogen, phosphorus, potassium, calcium, and magnesium than did similar desirable plants of Southern Magnolia. Recently matured leaves of both species were used for analysis. A leaf was considered to be recently matured if it was thickened, expanded, glossy, dark green in color, and was located immediately below lighter green, less thickened, and expanded leaves.

Outstanding plants of Roundleaf Japanese Holly in the Semmes, Alabama, area were found to contain the following foliar nutrient elements on a me./100 gm. of leaf basis in early October, 1959:

Nitrogen	Phosphorus	Potassium	Calcium	Magnesium
590	44	44	36	25

Similar plants of Southern Magnolia in the Semmes, Alabama, area contained the following foliar nutrient elements on a me./100 gm. of leaf basis in early October, 1959:

Nitrogen	Phosphorus	Potassium	Calcium	Magnesium
306	15	23	29	26

A presentation was made on the outstanding pitfalls in the employment of foliar analysis as a diagnostic tool for evaluating the status of ornamental plants, and recommendations were given for future research using the foliar analysis technique.

Microfilm \$2.75; Xerox \$9.25. 202 pages.

POTASSIUM FIXATION AND RELEASE
CHARACTERISTICS OF CLAY MINERALS
AND THE RELEASE OF POTASSIUM
FROM SOILS TO CROPS AND TO
CHEMICAL EXTRACTANTS

(Order No. Mic 61-2843)

Graydon Edward Richards, Ph.D.
The Ohio State University, 1961

An experiment was conducted to determine the ability of soil tests to reveal the residual potassium that was available to alfalfa after an extended cropping period following fertilization. The effect of the method of sampling soils on the results of soil tests as an index of residual potassium was studied. In addition, an experiment was set up to determine whether established plants could secure potassium which was not available to newly seeded plants.

The results of the first experiment indicated that appreciable differences in potassium available to alfalfa were barely detectable by soil tests. The sampling method was found not to be the primary reason for the failure of soil tests to reveal plant available potassium. The third experiment revealed that established plants were able to secure potassium which was neither available to newly seeded plants nor detectable with soil tests.

In a separate study, the potassium fixation and release characteristics of six clay minerals and seven soil colloids (clays separated from soils) were determined under moist and dry conditions. Mixtures of clay minerals were prepared in the same proportions as in the soil colloids and were similarly studied. Calculated values based on the

contribution of each mineral to the exchangeable potassium content were reasonably close to the values for mixtures of clay minerals. However, the soil colloids were much lower in exchangeable potassium because of the greater fixation of applied potassium than were the comparable clay mineral mixtures. This may be due to differences in the state of weathering or the inability of existing techniques to determine precisely the clay mineral content of soil clays. Microfilm \$2.75; Xerox \$8.60. 190 pages.

**SEEDLING VIGOR IN BIRDSFOOT TREFOIL
(*LOTUS CORNICULATUS* L.).**

(Order No. Mic 61-2448)

Richard Marwood Shibles, Ph.D.
Cornell University, 1961

The early seedling growth and development of birdsfoot trefoil (*Lotus corniculatus* L.) was studied in an effort to determine the factor or factors associated with differential seedling vigor between the Empire and Viking varieties. All investigations were performed under conditions of controlled environment.

Measurements of net photosynthetic rate of cotyledons and leaves revealed no varietal differences. Cotyledons and leaves both possessed a maximum net photosynthetic rate of about 4.7 micromoles of oxygen evolved per square decimeter of surface per minute at 25°C and 1.79 gram-calories per square centimeter per hour of radiation.

At any given seed size both varieties possessed a similar dry weight and photosynthetic (cotyledonary) area per seedling upon emergence. In subsequent growth, however, it was shown that, within any seed size group, there was a rapid divergence in both dry weight and photosynthetic area per plant, with the Viking variety being superior, i.e., Viking produced a greater quantity of dry matter and photosynthetic surface within a given time interval than the Empire variety. The larger photosynthetic surface of Viking was found to be due to larger individual leaves and cotyledons rather than greater numbers of leaves.

It was shown that, at any given time in the experimental period, the growth rate per unit photosynthetic surface was virtually identical between varieties. Viking seedlings were found to possess a higher ratio of photosynthetic area to total dry weight than Empire seedlings, indicating that a greater proportion of photosynthate was utilized in leaf and cotyledon growth than in the Empire variety.

It was concluded that the superior vigor of seedlings of the Viking variety, as compared to Empire seedlings from the same size seed, could be attributed to its ability to produce a greater photosynthesizing surface within a given time interval. Microfilm \$2.75; Xerox \$4.40. 82 pages.

**AN EVALUATION OF METHYLCELLULOSE
AND PAPER SEED RIBBONS FOR THE
PRECISION SEEDING OF LETTUCE
(*LACTUCA SATIVA* L.) AND
OTHER VEGETABLES.**

(Order No. Mic 61-2716)

Nicky Allan Smith, Ph.D.
Michigan State University, 1961

Major Professor: H. J. Carew

Individual plants of numerous agricultural crops must be spaced fairly accurately in the field for maximum yield and quality. Although the distance between individual wheat, oat, and corn plants, within certain limits, has little influence on yield or quality, accurate plant spacing is almost essential for lettuce, celery, cauliflower, and many high-value vegetable crops.

The thinning operation accounts for a sizeable portion of labor costs in the production of many small-seeded vegetable crops. Reducing the amount of seed used and uniformly spacing the quantity planted should result in a considerable saving in labor requirements.

This study evaluates two forms of seed ribbon or tape developed to achieve a uniform spacing of seed; plastic ribbon and paper ribbon. The plastic seed ribbon, composed of readily dissolvable methylcellulose, was used to place lettuce seed at intervals of 1 1/4, 7, and 3 1/2 inches in organic and mineral soils on commercial farms and in other experimental plots.

Placement of the ribbon in the soil was by means of specially built or adapted planters provided by two commercial firms.

Precision spacing of the seed reduced drastically the time required for thinning, varying directly with the seed interval. However, if weeding and thinning were performed simultaneously, as they usually are, time-saving benefits of spaced seeding became insignificant as the weed population increased.

At harvest, the lettuce stand from ribbon seedings was below that achieved by direct seeding; 90% of the ideal population was considered as acceptable commercially.

Spacing the same number of seeds to correspond with the desired final mature plant population resulted in an average stand of 47.58%. In other words, more than 50% of the seed loci were not occupied with plants at harvest due to undetermined causes.

The methylcellulose seed ribbon in contrast to a standard seed sowing procedure resulted in a higher percentage of lettuce heads harvested, heavier average weight per head, and sturdier growth.

Other experiments were conducted with plastic and paper seed ribbons to evaluate associated physiological phenomena. Delayed thinning of lettuce resulted in reduced fresh weight of foliage and roots.

The number of seedlings emerging increased as the number of seeds was increased per locus (1, 2, and 4) under conditions of soil crusting but not when the soil was covered with polyethylene. When the surface of the soil was compressed at 1/2, 2, 5, or 10 psi, seedling emergence was reduced by 5 and 10 psi but not significantly so under conditions of these experiments.

Emergence from the paper ribbon for tomato, cauliflower, lettuce, and celery in the greenhouse was significantly

lower than from check plantings but considerably higher than was experienced in the field trials with tomatoes. Laboratory control of moisture and careful placement of ribbon partially contributed to this better emergence.

Varying the level of soil moisture from 11% to field capacity plus 8 mm. of water did not affect total emergence from methylcellulose seed ribbon.

When individual seeds of radish were precision spaced one inch from adjacent seeds, 65.79% of the harvested radishes measured 16-30 mm., a median marketable range, whereas when seed was distributed at random in the row, the percentage was 49.45. In other words, precision spacing markedly increased root diameter uniformity.

Methylcellulose and paper seed ribbons or tapes were used successfully to space vegetable seeds at fairly precise intervals in the soil. Under field conditions, however, emergence was generally no greater than 50% indicating that precision seeding to a final desired plant population with these ribbon materials would be impractical. Precision seeding to reduce the thinning-labor requirement, rather than to eliminate it, was practical only if in-the-row weed populations were low.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

THE BREEDING BEHAVIOR OF SELECTED VARIETIES OF THE RED RASPBERRY ESPECIALLY WITH RESPECT TO CERTAIN FRUIT CHARACTERS WHICH MAY BE RELATED TO SEEDINESS

(Order No. Mic 61-2160)

Thomas Kazuo Toyama, Ph.D.
University of Minnesota, 1961

A study was made of the breeding behavior of selected varieties of the red raspberry with respect to certain fruit characters, especially those which may be related to the relative seediness of the fruit.

Nine varieties were crossed in all combinations including reciprocal crosses and also were selfed. Fruit samples were collected from the seedlings, and data were obtained for the following six characters: (1) weight per fruit, (2) number of drupelets per fruit, (3) weight per drupelet, (4) weight per heavy seed, (5) percentage of light seed, (6) percentage seediness. Data on these same characters for the parents were obtained from another source. Weight was used as the measure of size in this study.

The plot means for the cross progenies were analyzed for differences in general combining ability, specific combining ability and reciprocal crosses. Significant differences in general combining ability were found for all six characters. Significant differences in specific combining ability were found in a few cases for mean weight per drupelet and mean percentage seediness. One significant difference between reciprocal crosses was found for mean weight per heavy seed and one for mean percentage seediness.

For the self progenies, significant differences among the means were obtained for all six characters.

All tests of significance were made only at the one percent level.

The frequency distributions indicated that all of the characters are quantitatively inherited.

Among the self progenies, those of Chief, Madawaska and Honeyking had relatively high percentages of survival and fruiting.

The ranges of variation of the parent means and self progeny means were distinctly greater than those of the general combining ability means.

Correlation studies showed that, in this experiment: (1) better estimates of the breeding value of the parents were obtained from the parent means than from the self progeny means; (2) partial dominance in inheritance occurred for light fruit over heavy fruit, for heavy seed over light seed, and for high percentage of light seed over low percentage, and no dominance in the inheritance of the remaining three characters; (3) the cross progeny means were relatively good criteria of the magnitude of the extreme segregants in the respective progenies.

Neither the rankings of the progeny means nor variation in progeny variability could be attributed to differences in strigosus-idaeus hybridity among the crosses or to the limited inbreeding in the crosses between closely related parents. No association was noted between incidence of light seeds and degree of hybridity.

There was a tendency for seed weight to increase and percentage seediness to decrease as fruit size increased. Differences in seed weight and in percentage seediness were relatively small among the large-fruited seedlings.

It was concluded that intensive efforts to breed toward smaller seededness or lower percentages of seediness would not be worth while.

The characters studied did not appear to be affected adversely by the inbreeding in the crosses between closely related parents. It was suggested that the possibility of developing superior parental lines through sib-crossing be investigated. Microfilm \$2.75; Xerox \$4.80. 95 pages.

AGRICULTURE, PLANT PATHOLOGY

COMPARISON OF THE PHYSIOLOGY OF CERTAIN ISOLATES OF COLLETOTRICHUM GRAMINICOLA AND THEIR PATHOGENICITY ON WHEAT

(Order No. Mic 61-2815)

Mohammad Myser Ali-Miah, Ph.D.
The Ohio State University, 1961

Plant pathogenic fungi may be morphologically similar but pathogenically different. Colletotrichum graminicola (Ces.) Wils., the causal organism of anthracnose of grasses, is a good example. It is commonly believed by plant pathologists that differences in the pathogenicity of morphologically similar fungi may be due to differences in their physiology resulting from their differing genotypes.

It would be desirable to learn more about the physiological and pathogenic differences of these pathogenic fungi in order to develop more effective means of controlling them. In this investigation, the physiology of three isolates

of C. graminicola (from wheat, alfalfa, and orchard grass) and their pathogenicity on certain varieties of wheat were studied and compared. The physiology of isolates was studied in chemically defined liquid media in relation to utilization of certain organic and inorganic compounds, effect of pH values, temperature, light, and factors influencing their sporulation.

On the carbon sources, the alfalfa isolate grew best (on the basis of dry weights of mycelia) with d(-) levulose; the orchard grass isolate grew best with d(+) raffinose; and the wheat isolate grew best with sucrose and dextrose. All three isolates grew least with d-mannitol. On the nitrogen sources, the alfalfa isolate grew best with L(+) asparagine and yeast extract, and the wheat isolate grew best with L-arginine, ammonium nitrate, and potassium nitrate. All isolates grew least with DL-tryptophane. While the dry weights of the alfalfa isolate in a medium with glucose increased in light, the dry weights of the wheat and the orchard grass isolates decreased in light. The possible reasons for the differential reactions of the isolates to light have been discussed. The utilization of certain carbon and nitrogen sources by the three isolates also depended on their precultural substrates. The filtrate of an Alternaria sp., associated in tissue isolations, inhibited the development of the three isolates of C. graminicola as measured by dry weights.

The dry weights of the isolates were differentially influenced by magnesium sulfate, ammonium nitrate, and potassium nitrate. The dry weights of all three isolates were reduced in media without magnesium sulfate. The dry weights of the wheat isolate increased in a medium with the least amount of ammonium nitrate, but the dry weights of the other isolates remained unaffected by the different contents of this compound in the medium. All three isolates utilized very little nitrate nitrogen at lower pH values of the medium.

All three isolates had two temperature-growth-optima, one at 20°C and the other at 30°C, and two minima, one at 10°C and the other at 25°C.

The dry weights of all three isolates were affected similarly by the pH values of the medium. At pH values (4.0-6.0), the dry weights of all three isolates increased, but at higher pH values, the dry weights decreased.

The formation of acervuli and conidia by the three isolates was greatly influenced by aeration. Carbon and nitrogen sources influenced acervuli formation by the orchard grass isolate but not by the wheat and alfalfa isolates. Glucose content of the medium had no influence on acervuli formation.

Pathogenicity of the isolates was studied in relation to susceptibility of six varieties of wheat (Dual, Butler, Knox, Lucas, Seneca, and Vermillion), concentration of ammonium nitrate, potassium nitrate, magnesium sulfate, and hydrogen ions in the soil. Only the wheat isolate was pathogenic on wheat. The wheat variety, Dual, was highly susceptible and the Knox variety highly resistant. As in the case of the dry weights, the pathogenicity of the wheat isolate was also influenced by the inorganic compounds and the hydrogen ion concentration. With increase of potassium nitrate concentration in soil, seedling blight decreased, but with increase of ammonium nitrate and magnesium sulfate in soil, seedling blight increased. At high concentrations of ammonium nitrate and magnesium sulfate in soil, seedling blight decreased. The percentage of seedling blight was greatest at higher pH values of soil.

Microfilm \$2.75; Xerox \$3.60. 65 pages.

SEASONAL POPULATION VARIATIONS
OF PRATYLENCHUS PENETRANS (COBB)
ON STRAWBERRY AND SOME ASPECTS OF
ITS BIOLOGY UNDER LABORATORY CONDITIONS

(Order No. Mic 61-2182)

Anthony Alexander Di Edwardo, Ph.D.
Rutgers University, 1961

Major Professor: Dr. William R. Jenkins

It was the purpose of this research to determine effects of various ecological factors on the seasonal variation of Pratylenchus penetrans (Cobb) populations in strawberry roots and associated soil and to study certain phases of the biology of P. penetrans.

Samples from strawberry were collected at bi-weekly intervals from October, 1957 to May, 1958 and at weekly intervals from June, 1958 to September, 1958. Nematode populations in both roots and soil fluctuated but definite trends existed according to the different seasons. Soil populations from October to April ranged from less than 50 to 500 per 100 cc. of soil, with the lowest numbers occurring in January. Soil populations reached a peak of 1100 per 100 cc. of soil in early June. They then slowly declined until the beginning of September, when they leveled off at approximately 500 per 100 cc. of soil.

Root counts from October to January ranged from 400 to 900 per gm. of root and then increased steadily until the latter part of July when a peak of approximately 200 per gm. of root was reached. Population density in roots decreased rapidly to 600 per gram of root in the latter part of July as the result of increased growth activity in root systems. During September, nematodes per unit volume of root increased again as they began moving into new roots and root growth slowed. Pratylenchus penetrans was the predominant plant-parasitic nematode present in both soil and root samples. Ditylenchus spp., Aphelenchus spp., Aphelenchoïdes spp., Tylenchorhynchus claytoni, Xiphinema americanum, Tylenchus spp., Criconemoides spp., Paurodontus spp., Meloidogyne hapla and Helicotylenchus spp. were present in soil samples in small numbers.

A time lapse photomicrographic mechanism was devised and used to record the embryonic development of P. penetrans over a period of two weeks. It was possible to establish some time relationships of events which occurred during embryogeny. The time which elapsed between beginning and end of cell cleavage in the early stages was from 4 to 10 minutes and the time between second and third cleavage was approximately 10 hours at 70°F. The tadpole stage was reached 120-140 hours after the two-cell stage and the stylet was first visible after 192 hours. Incubation time for P. penetrans eggs under laboratory conditions was 12-14 days at 70°F. Immediately before hatching, the egg shell became thin and extremely plastic, and hatching occurred when the young larva broke through one end of the egg shell. Eclosion took only a few seconds once the egg shell was penetrated.

P. penetrans larvae and adults appeared to be attracted to cracks in roots and were apparently able to gain ingress through such cracks. Larvae and adults were also observed penetrating directly through the epidermis. In some observations recorded on film, nematodes were seen moving within roots at rates exceeding two mm. per minute. Within roots, nematodes appeared to feed by thrusting and withdrawing the stylet in rapid succession.

The number of thrusts per minute was not uniform, but at times, the frequency was as high as 140 per minute.

P. penetrans caused extensive injury to the cortical region of excised corn roots in culture. Large cavities were formed in the cortex and cytoplasm in some cortical cells was dense and granular-appearing after staining. The pericycle and conducting elements apparently were not affected by this nematode.

Microfilm \$2.75; Xerox \$3.60. 64 pages.

**INHERITANCE OF REACTION TO
PUCCINIA SORGHI SCHW. AND GENETIC
RELATIONSHIPS OF ALLELES AT R_p LOCUS
ON CHROMOSOME X IN 6 CORN LINES.**

(Order No. 61-2966)

Bae Ham Lee, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor James G. Dickson

Data on the inheritance of rust reaction in 6 corn lines B216, B217, Golden Glow, Golden King, Synthetic A and Black's Yellow Dent and the genetic relationships between the 6 corn lines and 4 previously studied (Cuzco, B38, GG208R, and K148) are presented and discussed.

The 6 sources of the dominant type of resistance to specific lines of *P. sorghi* were isolated in inbred lines. Some of these undoubtedly were the same alleles described earlier by Russell and Hooker in 1959 for they were isolated from similar open-pollinated varieties and they reacted identically to some lines of the pathogen.

Data on segregations in the F_2 and backcross progenies of resistant X susceptible crosses showed that the resistance in each corn line was conditioned by a single, dominant Mendelian factor. The F_3 data on segregation in one cross, Black's Yellow Dent X B14 (B14 susceptible to all biotypes), and the segregation in the progenies of [(resistant X susceptible) X susceptible] X susceptible in the other 5 crosses confirmed the single, dominant gene mode of inheritance.

The use of the simplest fit for rust reaction in the host-parasite interaction; namely, R (resistance dominant) and r (susceptibility recessive) and A (avirulence dominant) and a (virulence recessive) and segregation data in the progenies of (resistant X resistant) X susceptible suggested that the genes governing resistance were either in an allelic series or involved different loci that were closely linked. However, the use of only two phenotypic rust reaction classes (resistant and susceptible) gave little information on the interrelationships existing between the alleles identified.

The use of the full range of phenotypic expression of rust reaction in the uredial stage, i.e., O, X, 2 and 3-4 and the application of the functional test of complementarity between the alleles gave more detailed information on their genetic relationship and function. Inheritance data from the segregating generations of the crosses between the 10 inbred lines of corn and crosses to a homozygous susceptible line indicated 4 groups or functional units as follows: 1) Cuzco; 2) B38, B216 and B217; 3) GG208R, Golden Glow and Golden King; and 4) K148, Synthetic A and Black's Yellow Dent. However, the data obtained were inadequate

to differentiate fully between group 3) B38, B216 and B217 and group 4) K148, Synthetic A and Black's Yellow Dent. The genes conditioning rust reaction within each of the 4 groups are the same or closely linked alleles within the same functional unit. The application of the functional test of complementarity between the alleles appeared to rule out the condition of pseudoallelism. The accumulation of additional data from specific recombinant tests is in progress to confirm the genetic relationships of the alleles and the apparent complementary reactions. These data are needed also to define the genotypes involved and the full significance of the mesothetic X reaction which has been disregarded in previous genetic studies of rust reaction.

Microfilm \$2.75; Xerox \$3.00. 47 pages.

**TRANSMISSION OF POTATO LEAFROLL
AND BARLEY YELLOW DWARF
VIRUSES INJECTED INTO APHIDS**

(Order No. Mic 61-2450)

Walter Carl Mueller, Ph.D.
Cornell University, 1961

Research on the purification and properties of persistent aphid-borne viruses is hampered by the lack of method for the detection of these viruses in preparations under study. One solution to this problem is the injection of virus preparations into the aphid vectors which then transmit the virus to appropriate test plants. A simple injection technique for such use was developed; it proved partially satisfactory with potato leafroll virus and highly successful with barley yellow dwarf virus.

The injection apparatus consists of a glass needle connected by rubber tubing to a rubber syringe bulb. The needles are prepared from 2-mm glass tubing heated and drawn 3 times to a final diameter of 40 to 50 μ . Aphids anesthetized with CO_2 are held with a camel's-hair brush and injected between the abdomen and thorax on their dorsal surface; 1-2 mm of material in the end of the needle is forced into the aphids by pressing with the foot on the syringe bulb placed on the floor. The estimated volume injected is between 0.002 and 0.006 μ l.

Mortality of the injected aphids depends primarily upon the condition of the aphids and the type of material injected; mortality of large apterous aphids injected with water is less than 10%. Crude plant juice, in contrast, is quite toxic, resulting in up to 100% mortality.

Excellent transmission to oats of barley yellow dwarf virus was obtained after injection of English grain and apple grain aphids with haemolymph or haemolymph extracts from viruliferous aphids or with crude juice from infected oats. In all cases each type of aphid transmitted only the strain regularly transmitted by it. This was also true after injection of preparations containing 2 strains.

In tests with English grain aphids, virus was detected in the haemolymph after a 1-day acquisition feeding; injected aphids transmitted virus 1 day after injection. Single aphids injected with haemolymph transmitted to 37.7% of the plants fed upon.

Transmission occurred when infected-oat preparations that were clarified by freezing or by treatment with chloroform were injected into English grain aphids. Virus was

also detected in preparations subjected to ultracentrifugation and density-gradient centrifugation.

In marked contrast, transmission to Physalis floridana of potato leafroll virus by green peach aphids injected with haemolymph extracts was generally low, apparently because of the erratic feeding behavior of the aphids on this test plant. Few injected aphids fed well for the full test feeding time of 5 days; most ceased feeding 1 day after injection. No transmission was obtained from aphids that died within 3 days following injection.

Transmission by the tobacco strain of the green peach aphid was similar to that by the regular strain; the ability to transmit after injection appears not to be an heritable trait possessed by only a small percentage of the aphid population.

Transmission by injected aphids varied with the season, with maximum transmission coinciding with the times when the aphids were in the best physiologic condition. Transmission was not improved by rearing the aphids under constant conditions.

P. floridana was found to be an unsuitable host for injected green peach aphids. Attempts to increase transmission by feeding the injected aphids for various intervals on radish before transfer to P. floridana were unsuccessful.

The injection method described has proved of great value for the assay of barley yellow dwarf virus; its use with potato leafroll virus is hindered by unknown factors affecting transmission and by the lack of a suitable host plant for the injected aphids.

Microfilm \$2.75; Xerox \$4.40. 81 pages.

**STUDIES ON THE TRANSMISSION OF
CUCUMBER MOSAIC VIRUS BY
THE GREEN PEACH APHID,
MYZUS PERSICAE (SULZ.).**

(Order No. Mic 61-2445)

Andreas Papasolomontos, Ph.D.
Cornell University, 1961

The beneficial effect of fasting and the detrimental effect of prolonged access periods on the transmission of cucumber mosaic virus (CMV) by the green peach aphid, Myzus persicae (Sulz.) was investigated.

It was found that increases in access time resulted in a corresponding increase in the number of aphids that settled down to continuous feeding. Thus a proportionally greater number of aphids were interrupted at the end of the longer access periods than at the end of the shorter ones. Interrupted and noninterrupted aphids transmitted CMV equally well up to an access of 4 minutes, but interruption beginning with the 5th minute of access and over was increasingly detrimental to vector efficiency. Noninterrupted aphids on the other hand transmitted the virus with approximately equal efficiency from 1 to 15-minutes access, but vector efficiency was decreased after a 25-minute access.

Interrupted aphids invariably had their stylets extruded beyond the labium. The longer the access period the greater the length of stylet extrusion and the greater the loss in vector efficiency. Noninterrupted aphids, after the short access periods, tended to cover their stylets as they

naturally terminated their probes. Following the 25-minute access, however, a large proportion of these aphids had their stylets extruded for various distances. This corresponds with a drop in vector efficiency following 25-minutes of noninterrupted access.

Treatments which prolonged the time for which stylets remained exposed to the atmosphere resulted in a marked reduction in vector efficiency. Immobilization with CO₂ was employed to prolong the time for which the stylets of interrupted aphids remained exposed to the atmosphere.

Prolonged access periods were found not to reduce vector efficiency, provided the aphids' stylets were completely covered by their labia immediately after the natural termination of their probes. Actually such aphids transmitted the virus more efficiently after 15 and 25-minute access than they did after a 2-minute access.

Fasted aphids were found to be much more active than nonfasted ones. They made many more probes of a shorter duration than did the nonfasted ones over a 5-minute access period. When given an acquisition period of 14 seconds, the fasted aphids were however the better vectors. Penetration rates of the two groups of aphids however have shown that almost twice as many of the fasted aphids penetrated the leaf tissue during a 14-second acquisition period as did the nonfasted ones.

The results of this investigation would indicate therefore that the loss in vector efficiency following long access periods is probably due to the length of time for which the aphid stylets, and any virus particles that may be borne on them, remain exposed to the atmosphere. The longer the time for which the stylets remain exposed the greater are the chances of the virus losing its activity. The beneficial effect of fasting (before acquisition) on subsequent transmission appears to be due largely to the effect of fasting on penetration during access or acquisition periods. Fasted aphids penetrate more often than do the nonfasted ones.

Microfilm \$2.75; Xerox \$3.00. 57 pages.

**NITROGEN SOURCES IN RELATION TO
SUBSEQUENT VIRULENCE OF
COLLETOTRICHUM PHOMOIDES**

(Order No. Mic 61-2857)

Floyd James Williams, Ph.D.
The Ohio State University, 1961

Several workers have reported non-genetic changes in virulence in plant pathogens, but in many cases the data were inconclusive because no effort was made to obtain and maintain a single biotype of fungus. In this study a serially single spored strain of Colletotrichum phomoides was cultured on media containing different nitrogen sources and its virulence was checked by inoculating tomato fruits and measuring lesion diameter. In several tests, when initial pH values of media were adjusted and unadjusted, the isolate was more virulent after culture on a sodium nitrate medium or an alanine medium than after culture on an aspartic acid medium. Because of the variation between fruits, the mean lesion diameters in several tests were not significantly different at the 5 per cent confidence level. In one test in which virulence was compared on the

same fruit, the differences were significant. The cultural characteristics of the isolate after transfer from the different media were compared with the original culture and were found to be similar.

It is concluded that the previous nitrogen source may

affect subsequent virulence of *C. phomoides*, but that the measure of virulence used (lesion diameter) is not sufficiently precise to detect consistently the effects, because of the variation between tomato fruits.

Microfilm \$2.75; Xerox \$3.00. 39 pages.

ANATOMY

OBSERVATIONS ON THE EFFECTS OF PINEALECTOMY IN TURKEY POULTS AND ON THE DEVELOPMENTAL ANATOMY AND HISTOCHEMISTRY OF THE PINEAL ORGAN

(Order No. Mic 61-2816)

Martin York Andres, Ph.D.
The Ohio State University, 1961

An improved surgical procedure is described for pinealectomizing birds. This technic should permit recovery rates above 90 per cent and reduce pineal fragments in all birds. Incompletely pinealectomized birds can be rejected at the time of operation.

Studies of the influence of pinealectomy and sham operation were conducted on the body weight and bone measurements, and both groups were compared with control groups. The results of these studies were compared statistically to determine whether variations occurred between groups or sexes. Statistical comparisons were made on three phases of the study: the time required to attain 30 per cent of the mean maximal measurement, the mean maximal measurements, and the growth rate when expressed as a percentage of the mean maximal measurement at any time t . These investigations show that the principal observed effects are a product of the sham operation, since the mean maximal measurements of the pinealectomized and sham-operated groups are significantly greater than those of the controls. This finding may indicate that the surgical procedure, though improved, still does not demonstrate conclusively the effects of pinealectomy as a separate entity.

The external secondary sexual characteristics were observed, but none were found to be constant enough in development to be utilized as a measure of sexual maturity. Observations of sexual instinct, egg laying, and egg fertility were made, and no significant findings were noted.

Developmental processes of the turkey pineal were studied and compared with those of the chicken. The presence of a parietal organ is illustrated and discussed.

Weight and histological studies were performed on the testes, pineal organs, thyroid, adrenal, and pituitary glands collected at 34 weeks of age, the time of necropsy. These results were compared statistically and no significant variations were noted.

Cytological and histochemical studies are presented for the turkey pineal.

Limited studies of blood cell counts, hematocrits, and serum electrolytes are presented and discussed.

Microfilm \$3.00; Xerox \$10.60. 232 pages.

A CONTRIBUTION TO THE HISTOCHEMISTRY OF MAMMALIAN DEVELOPMENT

(Order No. Mic 61-2819)

John Charles Bartone, Ph.D.
The Ohio State University, 1961

This investigation has utilized a common species, *Sus scrofa*, much used in studying mammalian embryology, as a basis for a histochemical study of development.

The following histochemical methods were employed: periodic acid Schiff with diastase digested controls to reveal the presence of glycogen, toluidine blue to demonstrate ribonucleoprotein and acid mucopolysaccharides by orthochromatic and metachromatic staining, alkaline glycero-phosphate technic of Gomori for the demonstration of alkaline phosphatase activity, and the Barrnett and Seligman method for the detection of protein bound sulphydryl groups.

The characteristic embryonic period studied has all major primordia established. The nervous system, heart, liver, and mesonephros have undergone the most rapid growth and may have achieved functional status. Functional roles have not been attained by the lungs, stomach, intestines, metanephros and genital system, although growth increases are also evident.

Alkaline phosphatase activity is concentrated in the most rapidly growing tissues, as the neural tube, gut tract, and liver. Alkaline phosphatase may serve as a growth indicator.

Glycogen was observed in massive amounts in the heart, liver, epidermis, and foregut regions. The nervous system in general showed but faint traces of glycogen, but none were observed in the marginal zone or nerve bundles.

The functioning embryonic heart reveals a high glycogen content but low ribonucleoprotein concentration, and a low but increasing phosphatase activity, while maintaining consistent amounts of protein complexes.

Basophilia was marked in the neural tube (nuclear layers), gonads, liver, and intestine. Metachromasia was exhibited by the motor portion of the spinal cord, notochordal sheath, and cartilage.

Protein bound sulphydryl groups are in heavy concentrations in the neural tube, some sense organs, heart, gonads, and kidneys. None were detected in nerves.

The growth of the nervous system is correlated with heavy concentrations of ribonucleoprotein, sulphydryl groups, and moderate alkaline phosphatase activity.

Nerves reveal chiefly an alkaline phosphatase activity.

Ganglia have decreasing glycogen content from Group I to III, but were otherwise moderately reactive in other tests.

Metachromasia was observed in the motor part of the spinal cord in Group II, indicative of acid mucopolysaccharides.

The heart exhibited heavy amounts of glycogen and protein bound sulphydryl groups, but smaller amounts of ribonucleoprotein and alkaline phosphatase.

The liver revealed extreme or heavy reactions when tested histochemically for glycogen, ribonucleoprotein, phosphatase activity, and protein bound complexes.

Presumptive skeletal muscle was moderately reactive in all reactions and had increased protein complex content.

The generalized endothelium possesses strong alkaline phosphatase activity and sulphydryl content.

The spleen was moderate in phosphatase activity and sulphydryl content. It was not present in Group I. However, in Groups II and III, it had increasing ribonucleoprotein material and a decreasing glycogen content, while other diastase resistant substances became apparent in Group III.

Observable differences are seen between the cells and sheath of the notochord. Increasing amounts of glycogen and sulphydryl groups are seen in notochord cells of the three groups. The sheath possessed mainly acid mucopolysaccharides in Groups I and II.

There is evidence of correlation in the chemical activities of the mesonephros and metanephros. The former attains a functional status first and then undergoes degeneration and replacement by the metanephros. The charts indicate that such a process is already begun in Group I. While both structures, the mesonephros as an organ and the metanephros as a primordium, possess glycogen, the content is slowly reversing from Group I to III. In Group III the mesonephros has lost its high glycogen content, while the metanephros has gained one. However, the mesonephros has increased its non-glycogen polysaccharide content with other materials. The metanephros has increased reactions from Groups I to III for sulphydryl groups and phosphatase activity (but apparently has not reached functional conditions), while the mesonephros is maintaining a somewhat steady state.

This study suggests that histochemical levels of development result from chemical differentiation in embryonic cells and tissues. Chemical differentiation precedes or foreshadows histogenesis and organogenesis. Chemical changes occur that bring about distinguishable characteristics among cells and tissues which produce specific results. The differentiation of an organism, with its implied structural complexity, has two meanings: morphogenesis and histogenesis. Both of these reside in the chemical nature and activities of cells.

Microfilm \$2.75; Xerox \$3.80. 66 pages.

THE DEVELOPMENT OF THE PANCREAS OF THE HUMAN FETUS

(Order No. Mic 61-2739)

James Loren Conklin, Ph.D.
University of Michigan, 1961

The gross, histological and histochemical development of the pancreas of the human fetus is described. The material studied consisted of seventy-three specimens

ranging in age from 3.5 weeks of development to term. These were either entire embryos or pancreata from fetuses.

Preliminary to a discussion of the development of the pancreas, the early development of the gut with its associated nerves and blood vessels is described in detail.

The pancreas is formed by the fusion of dorsal and ventral pancreatic primordia. The dorsal pancreas arises early in the fourth week as a dorsal epithelial evagination from the gut. The ventral pancreas arises late in the fourth week as a similar evagination in the angle of the hepatoduodenal junction. It shifts from this site subsequently and appears as an evagination of the common bile duct. The combined common bile and ventral pancreatic duct is designated as the hepatopancreatic duct. This duct arises from the right ventral aspect of the duodenum but due to rotation of the duodenum assumes a position on its left medial side. The dorsal pancreatic duct likewise shifts position to the left ventral aspect of the duodenum. At all stages of development, the dorsal pancreatic duct lies rostral to the hepatopancreatic duct. The dorsal pancreatic duct persists until approximately the tenth week of development. Fusion of the dorsal and ventral pancreata occurs at approximately 6.5 weeks of development (horizon XVII). The ventral pancreas contributes to only a small portion of the head of the adult pancreas. The remainder of the pancreas, i.e., the rest of the head, the neck, body, tail and uncinate process are derived from the dorsal pancreas. Both dorsal and ventral pancreata give rise to islets and acini.

The epithelial evaginations of the dorsal and ventral anlagen form a multibranched tubular system which becomes the duct system of the adult organ. Cells at the terminals of the smallest ducts begin to differentiate as acini during the twelfth week of development, and are characterized by the presence of increasing basophilia. Shortly thereafter, small, nonspecific esterase-positive granules appear in the basal cytoplasm. As the granules increase in size they fill the apical cytoplasm of the acinar cells. These granules are also positive after the dimethylaminobenzaldehyde reaction for the demonstration of tryptophan containing proteins. The acini offer no evidence of secretory activity during the fetal period. Glycogen is present in the ducts and acini until the twentieth week of development.

The first islet cell buds arise early in the eighth week from cells which are present in the walls of the future intralobular and intercalated ducts. The first indication of the differentiation of islet epithelium is the loss of glycogen from certain duct cells. The islets never contain glycogen at any stage of development.

The argyrophilic cell is the first islet cell type to appear and is present in the islet cell buds and the walls of the ducts during the eighth week of development. During the tenth week the alpha cells appear and are followed in the eleventh and thirteenth week by the delta and beta cells, respectively. The argyrophilic cells are intermediate in the formation of the alpha cell while the delta cell is intermediate in the formation of the beta cell. All islet cells are fixed cell types and conversion of alpha to beta cells was not observed.

The developing islet cell buds become intimately associated with sinusoidal capillaries of the stroma. During the fourteenth week the endothelium of the islet capillaries undergoes a thinning in localized areas. The following

week the beta cells adjacent to these areas exhibit morphological evidence of secretory activity. The secretory activity of the beta cells continues throughout the remainder of the fetal period. The alpha cells exhibit morphological evidence of secretory activity during the seventeenth week; however, from the eighteenth week until birth they exhibit no such activity.

The period of islet cell differentiation seems to coincide with the assumption of secretory activity by the thyroid, adrenal cortex and pars distalis.

Microfilm \$2.75; Xerox \$6.60. 136 pages.

MORPHOLOGIC OBSERVATIONS OF MAMMALIAN FETAL LIVER WITH PARTICULAR REFERENCE TO ERYTHROPOIESIS

(Order No. Mic 61-2829)

Joseph Anthony Grasso, Ph.D.
The Ohio State University, 1961

Correlated light and electron microscopic observations of erythropoiesis in the fetal liver of rabbit, pig, and human confirm the extravascular nature of the process of red blood cell development. Proliferating erythroid elements are located among the hepatic cells, which become compressed and distorted through the multiplication of the erythroid cells. There is no evidence that endothelial cytoplasm or a basement membrane intervenes between the hepatic and erythropoietic elements.

The reticulo-endothelial (RE) lining of the sinusoids appears to be discontinuous, thereby allowing a communication between the major vascular channels and the extravascular erythropoietic foci. It appears that red blood cells enter the general circulation in two ways: (1) through

the discontinuities in the sinusoidal lining and (2) by pushing between the thin cytoplasmic processes of the RE cells. Marked phagocytic activity is observed within the RE cells.

In the thirteen-day rabbit fetal liver, the earliest erythroid cell observed corresponds to the "hemocytoblast" of Maximow. The hemocytoblast is characterized by its large number of ribosomal granules within the hyaloplasm and a large vesicular nucleus in which several nucleoli may be prominent. The mitochondria and ergastoplasm are moderately developed. The Golgi complex is highly prominent, although it presents no unusual features. On occasion, it has been possible to recognize the centrioles in the region of the Golgi complex. Of particular interest is the occurrence of nuclear blebbing, which may indicate an active transfer of material from the nucleus to the cytoplasm.

As erythroid elements undergo differentiation, the most significant alterations appear to be (1) a decrease in ribosomal content (RNA), accompanied by an increase in hemoglobin, and (2) nuclear changes in which marked condensation of chromatin and loss of nucleoli are apparent. In addition, there is a general decrease of all cytoplasmic organelles. The process of nuclear extrusion has been rarely observed. Although the human erythropoietic cells exhibit minor differences in morphologic appearance, the process of red blood cell development is remarkably similar to that of the rabbit.

The hepatic cells of the rabbit and human fetal liver reveal a considerable development of all cytoplasmic organelles. Nuclear blebbing in liver cells is also observed to a greater extent than in erythropoietic cells. The vesicles arising from the nuclear envelope reveal a varied content, which is expressed as small microvesicles, particulates, or large dense granules. The similarity of the contents of the Golgi vesicles to those of the nuclear membrane is offered as support for the concept that the nuclear membrane is a further expression of the cytoplasmic membranous components.

Microfilm \$2.75; Xerox \$4.60. 88 pages.

ANTHROPOLOGY

GIVING, RECEIVING AND REPAYING: AN EXAMINATION OF THE IDEAS OF MARCEL MAUSS IN THE CONTEXT OF INTERNATIONAL TECHNICAL ASSISTANCE.

(Order No. Mic 61-1075)

Wilton Sterling Dillon, Ph.D.
Columbia University, 1961

This study seeks and finds a greater universality for the ideas of Marcel Mauss (1872-1950), the French sociologist who published, in 1925, an essay, The Gift: Forms and Functions of Exchange in Archaic Societies. Contrasting with Mauss' use of ancient families, clans, and tribes as units of analysis, this study describes and interprets the gift behavior of some selected individuals in contemporary Western industrial civilization. It deals with a social process involving the transfer of gifts (money, machines,

and knowledge) from a powerful, younger nation to a weaker, older nation. The United States and France are shown interacting with each other through individuals who enter into donor-recipient relationships as a result of the Marshall Plan. The thesis is that industrial men, no less than pre-literate and ancient men, desire to return gifts to donors to whom they feel obligated.

In bilateral technical assistance programs, the chances are great that recipients will feel hostility toward donors in the absence of ways and means to establish symbolic or actual reciprocity. Analysis of such exchange institutions as the Melanesian kula ring, described in Malinowski's Argonauts of the Western Pacific, suggests that pre-literate men have provided useful prototypes for designing aid programs which might build a rhythm of giving, receiving, and repaying into a system of distributing modern goods, techniques, and ideas.

Mauss' essay provides a conceptual framework for the

study. His three types of obligation (giving, receiving, and repaying) are used to interpret the behavior of Frenchmen whose culturally-determined notions of reciprocity leave them demoralized when they find themselves in an international situation, faced by donors who give aid, protection, and advice without provision for counterfeits except in the form of gratitude, anti-Communist votes, and permission to station troops on French soil. A life history of the chief informant, Monsieur B., provides a case study--a microcosm--of a whole set of geopolitical, cultural, and psychological dimensions affecting the ambivalent reactions of people who receive, toward those who give. American generosity is both desired and resented.

The period covered, 1951-1960, is presented against a cold war backdrop in which the U.S. and the U.S.S.R. are both trying to form military-political alliances out of dependent nations with older cultures but simpler technologies. Analysis of Monsieur B.'s role as a pupil-recipient vis-a-vis American teacher-donors reveals an interplay between French kinship, social class, religion, and education as factors influencing the transmission of the American gift, the idea of productivity.

What happens when repayment seems blocked? Compensations develop; the recipient improvises ways to return gifts in the form of grievances, unsolicited advice, or "unauthorized" action (e.g., the 1956 Suez crisis). Nativistic Gaullism symbolizes the French quest for autonomy and reciprocity, i.e., grandeur.

Out of empirical observations, a hypothesis is proposed: consultation can serve as a gift-returning mechanism. Intellectual goods can be returned for tangibles. Hierarchical differences between donor and receiver produce less strain when the donor asks the receiver to participate in decisions that affect them both.

Christian theology, theories and studies of leadership, obligation, interaction, communication, exchange and identity--all converge in this study. However, new empirical research and syntheses of the findings of behavioral scientists are needed to enrich further Mauss' already serviceable theory of obligation. For men of world affairs, the interim tasks are clear: match the wisdom of the kula inventors by creating a system of intellectual and technological exchange in which every participant is a potential donor and teacher.

Microfilm \$2.75; Xerox \$8.80. 193 pages.

**NAGURA MURA: AN HISTORICAL ANALYSIS
OF STABILITY AND CHANGE IN
COMMUNITY STRUCTURE.**

(Order No. Mic 61-1077)

Erwin Henry Johnson, Ph.D.
Columbia University, 1961

This is an analysis of family and community structure in Nagura Mura, a mountain agricultural village in Aichi Prefecture, Japan. It draws on material from historical documents dating back to the Middle Ages and attempts to integrate these with later records and with contemporary observations, to present a developmental picture of family patterns, inheritance patterns, hamlet patterns, etc.

This is done in order to examine and test theories and

postulates on the nature of the Japanese family and of its buraku-hamlet structure. A key form examined and tested by these village materials is the dozoku, an extended family incorporating many patrilineally related households into a single social and economic unit under the leadership and control of the senior descendant of the founder of the unit. Many scholars have postulated this form as comprising an underlying stratum for all of Japan, a heritage from earlier times. Included in the "ideal" dozoku is a group of fictive kin, adopted as workers within the large family unit. These fictive kin or nago are known in some regions to have supplied an important source of agricultural labor for large land holding families, in pre-market times.

Since modern Nagura showed no sign or vestige of such a form, historical records were examined to shed more light on the history of dozoku in that village. No historical evidence for the presence of dozoku in the past was uncovered. Instead, evidence which indicated a situation of kin-equality was encountered.

In addition the data indicate a basic status-equality among the occupants of each buraku-hamlet, re-enforced the feeling that early Nagura was not characterized by hierarchy or stratification, but by a general equality among the peasant householders of the village, at least from the 17th century to the present.

With this evidence as background, the modern village was examined and changes which have occurred in the 19th and 20th centuries noted. The area of change which was of primary concern was that of the community. The earlier community had been the buraku, the hamlet. The present community is the mura, consisting of eighteen buraku, with a core of mura wide institutions and agencies. It was noted that this change had occurred through the dropping of certain activities on the buraku level, as a result of modern changes which more or less eliminated the need for buraku activities. Such areas as communal rethatching of houses, for example, declined as more permanent roofing materials came to be used.

While the buraku declined, the mura took on activities which were new to village life. The net result of this change is that the buraku remains a stable unit with greatly reduced activities. The mura has developed also into a stable unit, with ever expanding activities.

Perhaps the most important result of this study is to demonstrate that non-hierarchical patterns of both kin and community structure characterize at least a segment of rural Japan. The final chapter of the study suggests that perhaps dozoku is a specialized, not a general pattern for Japan, a pattern which is stronger in some regions today than it appears to have ever been in the past.

Throughout the study, an effort is made to tie change in community and family patterns in with the local conditions. Nagura was remote from the Edo period national polity. No force acting to encourage stratification was made felt. Nagura is integrated closely with the national structure of today. With this integration, an economic stratification based on modern industrial classes seems to be emerging, quite independent of the older buraku and kin structures.

Microfilm \$2.90; Xerox \$10.15. 221 pages.

CULTURE CHANGE, SOCIAL STRUCTURE,
AND HEALTH BEHAVIOR: A QUANTITATIVE
STUDY OF CLINIC USE AMONG THE APACHES
OF THE MESCALERO RESERVATION.

(Order No. Mic 61-2766)

Peter Kunstadter, Ph.D.
University of Michigan, 1961

This study analyzes the use which is made of modern medical care by the contemporary residents of the Mescalero Apache Reservation of New Mexico. Use of modern medical care is measured by the number of visits each person made to the free Public Health Service clinic during a two-year period. Clinic-use data were obtained from hospital records. The explanation of the pattern of clinic use depends on knowledge of the contemporary social structure of the population, and on its history. Information on history and contemporary social structure was derived from historical records, documents, and interviews with native informants.

The history of the population is traced from the earliest contacts with the Spanish, through conquest by the Americans, to the establishment of the reservation and concentration of diverse Apache groups thereon. The destruction of the aboriginal economy and social structure is documented.

Contemporary demography and social structure are analyzed. The population is found to be undergoing rapid transitional growth, apparently as the result of reduced death rates which have accompanied the use of modern medicine. The contemporary kinship system is studied through an analysis of residence patterns. A rank-ordering of the intrafamilial bonds of solidarity is based on this analysis. Kinship relationships are shown to emphasize females and kin related through females. This pattern is related to the economic conditions of the reservation: the population has become dependent on wage labor and cash income from livestock and welfare, and women are economically favored in the contemporary economic structure.

A comparative study is made of the literature which deals with the use of medical facilities in non-Indian populations of the United States. The pattern of use which has been found is outlined, and some of the theories which have been offered to explain this pattern are discussed.

A description is made of the Mescalero clinic and hospital. Various alternatives to the use of the clinic are

described. Traditional Apache curing methods are seen as noncompetitive alternatives to the use of the clinic. This conclusion is based on the facts that Indian medicine men make considerable use of the clinic, and that no pattern of resistance to the clinic could be discovered which had its basis in the native curing system. Furthermore, historical records and the pattern of population growth indicate that modern medical care has been accepted for a number of years.

The pattern of clinic use is analyzed according to a number of variables. The pattern is found to be similar in most respects to patterns of clinic use found in non-Indian populations. A series of theories is offered as an explanation of the pattern of clinic use which has been described. Most of these theories are seen as complementary rather than mutually contradictory. The following conclusions are justified on the basis of the evidence which is presented:

1. Differences in clinic use are related to position in the contemporary social structure. The special position of women in the economic and kinship structures is shown to be reflected in the pattern of clinic use. A pattern of similarity of clinic use between parents and children which was predicted on the basis of an analysis of intra-family solidarity is demonstrated. This finding suggests the hypothesis that similarity in use of clinic is a function of solidarity within the group.

2. Differences in clinic use are related to differences in culture and acculturation. Acculturative differences are indicated between the aged (sixty years old and over) and the adults (age twenty through fifty-nine), but acculturation differences are shown to be inadequate to explain differences in clinic use within the adult group.

3. The pattern of clinic use within the Mescalero population resembles the pattern of use among non-Indian populations to the extent to which Mescalero social structure resembles the social structure of non-Indian communities.

4. Differences in clinic use are related to factors of convenience, as indicated by distance from place of residence to the clinic, and presence or absence of an automobile.

5. Differences in clinic use are determined by the pattern of morbidity within the population. For the most part these differences are related to differences in age and sex. Clinic use rates were age- and sex-adjusted to eliminate the effects of morbidity from the analysis.

Microfilm \$10.30; Xerox \$36.65. 815 pages.

ASTRONOMY

STUDIES OF SOLAR MICROWAVE EMISSION USING A HIGHLY DIRECTIONAL ANTENNA

(Order No. Mic 61-1042)

Govinda Swarup, Ph.D.
Stanford University, 1961

The brightness distribution across the sun has been studied at a wavelength of 9.1 cm using a highly directional antenna. The antenna, which consists of 32 10-ft paraboloids placed in the form of a Mills cross, provides pencil beams which are only 1/10th of the size of the sun. With the rotation of the earth, these scan the solar disk in a television fashion providing a two-dimensional map of the sun in a period of about an hour. Once such an antenna is constructed, the principal difficulty is to bring it into adjustment. This problem has been solved by introducing a new technique of phase measurement in which modulated gas discharges, placed near the horn feed of each paraboloid, enable rapid measurement of the phase at the center of the feeder system. The method has great promise for absolute phase measurement over unusually long distances and through heavy attenuation. Our experiments have shown that the method is also well suited for monitoring the surfaces of large paraboloidal reflectors.

The microwave spectroheliograms obtained by the author over a period of four months in 1959 and 1960 have given new significant information about the inner corona and on active regions on the sun. In spite of a high level of activity during the period of observations, we could identify the quiet-sun component because of the high resolution of the pencil-beam antenna. The quiet sun at 9.1 cm wavelength has a marked deviation from circular symmetry, the brightness temperature being about 3×10^4 °K at the center of the disk, 4.5×10^4 °K at the equatorial

limb and 2×10^4 °K at the poles. It is interesting to note that while the above measurements give a value of the electron density in the equatorial regions corresponding to that obtained from eclipse measurements during a sunspot maximum, the electron density at the poles is only about one-third of this, and corresponds to that observed during a sunspot minimum.

The sources of the slowly varying component of solar radio emission are closely associated with the chromospheric plages, as has been also concluded by previous investigators. But in contrast to the findings at 21 cm wavelength by Christiansen and Mathewson, our observations indicate that the peak of 9.1 cm emission lies above the center of gravity of a sunspot group and not above the plage. Also the size of the region is smaller at 9.1 cm than at larger wavelengths. It is concluded that the electron density distribution above a plage region is nonuniform, with higher density in the vicinity of sunspots.

At 9.1 cm, a typical source of slowly varying component during the period of observation had a diameter of about 3.5 minutes of arc, a brightness temperature of 4.5×10^5 °K (associated sunspot area is 700 millionths of solar hemisphere), and a height of 20,000 km. The variation of the radio emission as the region moved with rotation of the sun from the center to the limb was broader than the cosine variation expected for a disk-shaped emitting region. These characteristics are in accordance with the current hypothesis that the slowly varying component originates thermally from exceptionally dense regions lying above the chromospheric plages. Our observations suggest that the electron densities above an active region are about 10 times the normal value above the quiet sun, and are about 2 times the values assumed by Newkirk in his model of an active region.

Microfilm \$2.75; Xerox \$6.00. 123 pages.

BACTERIOLOGY

MECHANISMS OF GROWTH CONTROL IN BACTERIA

(Order No. Mic 61-2258)

Richard Eugene Ecker, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: W. R. Lockhart

The general topic of the use of growth kinetics in the study of microbial growth control mechanisms is considered, and the literature relative to mathematical expression of growth phenomena is critically reviewed. The use of lag characteristics as a tool in the elucidation of

the physiological status of parent cells is discussed. An equation is proposed to describe the nature of the early growth curve and account for the dependence of lag length on inoculum size. Data are presented to show that this equation can be used successfully to describe the nature of pre-exponential growth.

The linear relationship between maximum attainable growth and initial concentration of limiting nutrient is shown to occur only when cell mass is used as the growth parameter. When maximum cell numbers is the measure of growth, the relationship is found to be

$$N_{\max} = K' C_o^S,$$

where N_{\max} is the maximum attainable population, C_o is

the initial concentration of limiting nutrient and K' and s are constants. This phenomenon is discussed in the light of contradictory observations by several earlier workers and the use of the constants from this equation in demonstrating differences between closely related strains is considered.

Data are presented showing a decreased efficiency of glucose utilization during the lag and a dependence thereof on the size of the initial population. The implication of this effect in the design of experiments for study of glucose-limited growth is discussed.

Upon cessation of growth, glucose-, $(\text{NH}_4)_2\text{SO}_4$ - and oxygen-limited populations are observed to differ from one another in such properties as: a) relationship between mass synthesis and cell division; b) utilization of non-limiting nutrients; c) nature of changes in energy metabolism. These observations are discussed with particular regard to the problems involved in the experimental control of variables in the study of culture growth and the rational choice of dependent parameters for expressing the nature of changes in the physiological properties of such populations.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

THE SIMULTANEOUS LETHAL EFFECT OF TEMPERATURE AND GAMMA RADIATION ON BACTERIAL SPORES

(Order No. Mic 61-2754)

John Thomas Graikoski, Ph.D.
University of Michigan, 1961

The effect of the ambient temperature during irradiation on the lethality of gamma radiation from cobalt-60 for bacterial spores was investigated. Also, the phenomenon of radio-sensitization of bacterial spores to the lethal effects of heat was considered. Several strains of Cl. botulinum, another Clostridium species designated as putrefactive anaerobe, National Canners Association strain 3679 and spores from Bacillus subtilis var. niger were employed.

It was observed that the radiation resistance of these spores varied with ambient temperature during irradiation: both the degree of resistance and the temperature at which the greatest resistance occurred depended upon the species of spores used. In general, slightly greater resistance occurred at -72°C than at 4°C. As the ambient temperature of irradiation was elevated above 4°C, the resistance of the spores to radiation increased up to a maximum value which occurred at a temperature just below that designated in this study as the thermal-lethal threshold for the particular organism involved. With Cl. botulinum spores, maximum resistance was observed in the temperature range of 40 to 80°C; with putrefactive anaerobe spores this temperature was 99°C. Increasing the temperature above the lethal threshold during irradiation resulted in an accelerated rate of spore inactivation. The number of spores surviving at these higher temperatures was less than would have been expected from the independent effects of heat and radiation. These results indicate that irradiation sensitized the spores to the lethal effects of heat.

It was also observed that the thermal-lethal threshold was not lowered by pre-irradiation of the spores. However, heating previously irradiated spores at or above the thermal-lethal threshold increased the lethal effects of heat. The degree of sensitization to heat was dependent upon the total radiation dose that the spores received, but prolonged heating at sub-lethal temperatures did not change the subsequent resistance of anaerobic spores to radiation. Furthermore spores that were irradiated at different temperatures showed differences in subsequent heat resistance. This suggests that a common mechanism, responsible for spore survival and radio-sensitization, is affected by both forms of energy. It was postulated that the nucleoprotein, more specifically the deoxyribonucleic acid component, is important in this regard.

The practical significance of these results for irradiation sterilization purposes indicate: (1) Accurate determination of the sterilization dose involves consideration of the ambient temperature during irradiation. (2) In order to effectively utilize the phenomenon of radiation sensitization of bacterial spores to the lethal effects of heat, irradiation must be carried out at or above the thermal-lethal threshold of the organism in question; if the heat treatment is applied later, the temperature of such treatment must be at or above the thermal-lethal threshold.

Microfilm \$2.75; Xerox \$6.40. 135 pages.

MODE OF ACTION OF HEXACHLOROPHENONE

(Order No. Mic 61-2760)

Harry Loren Joswick, Ph.D.
University of Michigan, 1961

Hexachlorophenone (2,2'-methylenebis-3,4,6 trichlorophenol) or "G-11" is a chlorinated methylene bis-phenol which, because of its effectiveness as an antibacterial agent and its unique soap compatibility, has found wide practical application as a skin antiseptic. In general, the mechanism of action of hexachlorophenone appears related to that postulated for compounds having detergent or surface-active properties. The experimental investigation proceeded from the working hypothesis that, if hexachlorophenone were concentrated at the cell surface and disrupted permeability, leakage of cell contents with progressive loss of function and eventually death would result. The experimental results, which followed three lines of investigation, were consistent with the main features of this hypothesis.

1. Hexachlorophenone-induced release of intracellular materials.—The addition of hexachlorophenone to growing or washed susceptible cells resulted in the release into the suspending medium of relatively large amounts of small molecular weight materials: 260 m μ -absorbing materials such as purines and pyrimidines, inorganic phosphate, pooled amino acids, and breakdown products of protein and ribonucleic acid. Large molecular-weight materials, such as deoxyribonucleic acid or undegraded protein and ribonucleic acid were not released. The loss of vital substances was indicative of serious permeability malfunction and appeared to occur in two overlapping phases. A first and most rapid phase of release was distinguished from

a second and slower one by the relative sensitivity of the second to inhibition by low temperatures and by high concentrations of hexachlorophene. These and other observations suggested that enzymatic activity, in the form of autolysis, was intimately involved with the second phase of leakage but considerably less so with the first. In general, the primary leakage materials were thought to originate from the intracellular pool while the secondary leakage materials, which appeared essentially identical in chemical characteristics, were believed to be the result of autolytic degradation of macromolecules followed by leakage of the products. The fact that death of cells occurred in the relative absence of the second phase of leakage would imply that it is unnecessary for the lethal effect.

Examination of various bacterial species indicated that gram-positive species were more sensitive to the leakage-inducing and growth-inhibiting properties of hexachlorophene than were gram-negative species. This difference was attributed to the presence of relatively larger amounts of lipid in the cell walls of gram-negative organisms, serving to protect the vulnerable cell membrane which lies beneath.

2. Hexachlorophene-induced uptake of tolyl-peri acid.—Additional experimental evidence supporting the hypothesis of hexachlorophene-induced permeability derangement was obtained by the use of tolyl-peri acid. This dye, when combined with protein, fluoresces upon exposure to ultraviolet light. Addition of hexachlorophene to susceptible cells in the presence of tolyl-peri acid caused the immediate penetration of the previously excluded dye into protein-containing areas within the cell, a phenomenon which was observed by means of a conventional fluorescence microscope.

3. Hexachlorophene-induced cellular modifications.—Examination of hexachlorophene-treated cells by means of phase contrast and electron microscopy did not reveal significant differences from untreated cells, suggesting that the drug-induced damage is of a subtle nature. Disintegration of the cell walls of both gram-positive and gram-negative bacilli by controlled treatment with lysozyme, followed by hexachlorophene treatment, resulted in immediate rupture of the protoplasts or spheroplasts and escape of intracellular materials into the suspending medium. The fact that the gram-negative bacillus was resistant to the drug before, but not after, removal of the cell wall suggests that this structure is responsible for the observed resistance and that the cytoplasmic (protoplast) membrane is the site of the lethal physico-chemical action of hexachlorophene.

Microfilm \$2.75; Xerox \$6.00. 123 pages.

**INTERACTIONS BETWEEN
MAMMALIAN MONOCYTES AND
BRUCELLA ABORTUS IN VITRO:
A STUDY OF HOST-PARASITE RELATIONSHIPS.**

(Order No. Mic 61-2188)

Rosslyn William Ian Kessel, Ph.D.
Rutgers University, 1960

Major Professor: Werner Braun

Earlier studies on the relationships between Brucella abortus and mammalian monocytes in vitro have been extended.

The system employed involved the maintenance of peritoneal monocytes from guinea-pigs or rats in tissue culture, and the assessment of the extent and rate of ingestion and intracellular multiplication of B. abortus under conditions in which extracellular multiplication was prevented.

Improved techniques were developed that allowed a more efficient recovery of intracellular brucellae than had previously been possible. Methods were developed permitting the continuous intracellular cultivation of brucellae, without the intervening use of lifeless media. These involved the serial transfer of intracellular brucellae from old to new monocyte cultures. A technique for measuring deoxyribonucleic acid concentrations was adapted to assess the size of monocyte populations. A method was developed that allowed the manipulation of single, brucella-containing monocytes, based upon the ease of handling glass beads to which single cells have become attached. Its development has led to the feasibility of examining bacterial contents of single mammalian cells.

The fate of virulent or avirulent brucellae within monocytes from susceptible or resistant animals was investigated during continuous intracellular cultivation. It was possible to confirm the finding that rough B. abortus organisms are incapable of multiplying within monocytes of susceptible animals. Smooth B. abortus cells would survive indefinitely within monocytes from a susceptible animal, such as the guinea-pig, but were gradually eliminated from monocytes of a relatively resistant animal, such as the rat. These striking differences became apparent only when bacteria were permitted to reside in monocytes for several transfers; apparent "carry-over" effects were held responsible for the absence of such differences when only single cycles of intracellular cultivation were employed.

The effects of a number of compounds, known to affect the reticuloendothelial system and natural resistance, have been studied in the B. abortus-monocyte system. Compounds were either added directly to the monocyte culture, or injected into the animal from which monocytes were subsequently harvested. With the exception of a possible, slight, stimulation of the phagocytic ability of monocytes by cortisone, no effects were detected following in vivo or in vitro treatments with a variety of naturally occurring steroids, or with bacterial lipopolysaccharides.

The possibility that the ingestion of one, or a few, virulent brucellae renders monocytes less capable of ingesting additional virulent brucellae has been examined. The results, though not yet conclusive, suggest that such an interference exists.

The action exerted by brucellaphage upon intracellular brucellae has been studied. It was found that the addition

of brucellaphage to cultures of monocytes previously parasitized by phage-susceptible brucellae, caused an inhibition of intracellular bacterial multiplication. This inhibition seemed proportional to the amount of infecting phage, occurred also with extracellular bacteria, and was elicited by UV-inactivated but not by heat-inactivated phage. These findings led to the conclusion that the protein coat of the phage is responsible, but it remains uncertain whether the effect does or does not require direct contact between the phage and the bacterium.

Attempts have been made to ascertain whether genetic transfers may occur between brucellae, either in lifeless media or within monocytes. No recombinations have been detected, but the experiments cannot be regarded as sufficient to reject the possibility of their occurrence.

The significance of these data has been discussed with particular emphasis on natural relationships between an invading pathogen and potentially susceptible or resistant hosts.

Microfilm \$3.25; Xerox \$11.50. 252 pages.

A STUDY OF FACTORS AFFECTING ANTIBODY FORMATION BY SPLENIC TISSUES

(Order No. Mic 61-2765)

Yi-chi Mei Kong, Ph.D.
University of Michigan, 1961

Advances in our knowledge of cellular and biochemical processes in response to antigenic stimulus have been hampered by the complexity of the *in vivo* environment. This investigation was initiated, therefore, to study various factors affecting the ability of isolated rabbit splenic tissues to synthesize antibody when transplanted to either tissue culture or another rabbit. Particular emphasis was given to studies with these 2 systems on the role in antibody production of: (1) the interval between antigen injection and transfer of splenic tissues; (2) an adjuvant, bacterial endotoxin; and (3) the nucleic acids.

Antibodies, detected throughout this study by agglutination of erythrocytes coated with the antigen, bovine gamma globulin (BGG), were regularly demonstrated when splenic tissues were removed 3, 4, and 5 days following a single injection of the rabbit with the antigen, BGG, and cultured in roller tubes for 6 to 72 hours. Following a second injection of BGG, splenic tissues cultured for 24 to 72 hours *in vitro*, synthesized antibodies in higher titers; consistently when removed 2 to 3 days after antigenic stimulus, but sporadically when removed after 1 day. Endotoxin injected simultaneously with antigen into the rabbit did not appear to increase the primary or secondary antibody response of splenic tissues cultured *in vitro*.

The addition of BGG *in vitro* to splenic explants from normal or previously immunized rabbits failed to initiate a primary or secondary antibody response. However, a non-specific factor, inactivated when stored at -20°C overnight, was detected in splenic tissue culture originating from normal rabbits, those receiving endotoxin alone 24 hours before splenectomy, as well as those receiving endotoxin with antigen.

The capacity of splenic tissues to form antibody following the injection of BGG into rabbits was transferable to normal and x-irradiated recipients. Antibodies were

obtained in recipient animals after the intraperitoneal transfer of donor splenic cells removed 1, 2, and 3 days after antigenic stimulus. The effect of endotoxin, given either to the donor simultaneously with BGG or to the recipient immediately following cellular transfer, was investigated. Endotoxin, administered to either the donor or the recipient rabbit, appeared to induce the donor cells to synthesize more antibodies in a greater number of recipients when transfer was carried out 2 days after antigenic stimulation. When splenic tissues were transferred 3 days after BGG injection, endotoxin seemed to increase antibody formation only when given to the donor, but the percentage of recipients with detectable antibodies was equivalent in both endotoxin-treated and untreated groups.

Uracil analogues, 5-fluorouracil and 5-fluoro-2'-deoxyuridine in concentrations of 0.15 mM and 0.32 mM respectively, inhibited secondary antibody synthesis when added to splenic tissues obtained 2 days after a second injection of BGG. Preliminary experiments indicated that thymidine partially reversed the inhibitory effect of 5-fluoro-2'-deoxyuridine on secondary antibody formation by splenic tissues.

It was concluded that: (1) the primary antibody response of splenic tissues to a protein antigen was transferable to homologous recipients; (2) the interval between the parenteral injection of antigen into rabbits and the removal of splenic tissues was a critical factor for the successful demonstration of antibody synthesis *in vitro* or when transplanted to another host; (3) the adjuvant action of endotoxin on antibody formation was not observable when rabbit spleens were removed and cultured *in vitro*; (4) enhancement of antibody formation by endotoxin was suggested when administered either to the donor or recipient rabbit of splenic tissues; and (5) nucleic acids appeared to participate in antibody synthesis *in vitro*, as shown by the inhibitory effect of uracil analogues on secondary antibody formation.

Microfilm \$2.75; Xerox \$6.20. 127 pages.

STRUCTURAL AND PHYSIOLOGICAL ASPECTS OF GERMINATION OF CONIDIA OF *PENICILLIUM CHRYSOGENUM*

(Order No. 61-2961)

Joseph Morton Kornfeld, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Stanley G. Knight

When spores of *Penicillium chrysogenum* strain NRRL 1951-B 25 were incubated in a medium which contained ammonium nitrate as the nitrogen source and either glucose or xylose as the carbon source, germination, defined as the appearance of germ tubes, occurred in about 11-12 hours. Measurement of protein in sonically prepared extracts showed that it began to increase after about 4-5 hours of incubation.

Xylose reductase, an enzyme which catalyzes the reduction of xylose to xylitol in the presence of reduced triphosphopyridine nucleotide, has been found to be absent in extracts of spores harvested from tomato juice agar. If the spores were incubated in a medium which contained

glucose as the sole carbon source, no reductase activity could be detected in extracts of spores at any stage of germination. When D-xylose was substituted for glucose, a linear increase in the specific activity of the reductase was noted for about four hours, followed by a logarithmic increase. Addition of glucose to this medium produced a stimulatory effect on the induction of the enzyme at glucose concentrations of less than 10^{-3} M and a repressive effect at concentrations higher than this. When the spores were incubated in a medium which contained 10^{-3} M glucose and varying concentrations of xylose, there was a relationship between the specific activity of the reductase and xylose concentration which reached a maximum at a xylose concentration of about 5×10^{-2} M.

Examination of other enzymes during germination showed that the specific activities of glucose-6-phosphate dehydrogenase, 6-phosphogluconic dehydrogenase, and glutamic dehydrogenase increase; specific urease and alanine dehydrogenase activities decrease; and the specific activity of a DPNH-ferricyanide diaphorase system remains fairly constant. It is not clear, however, whether these enzyme patterns bear a causal relation to germination or are merely coincidental to it.

When the spore extracts were examined in the analytical ultracentrifuge, the presence of three centrifugally defined classes of ribosomes were revealed. These particles have sedimentation coefficients of 40 S, 60 S, and 80 S when corrected to 20 C and extrapolated to infinite dilution. In freshly harvested spores, the 80 S particle is the dominant species, with less of the 60 S particle and only barely detectable amounts of the 40 S particle. As germination proceeds, the apparent ratios of the particles change, although the 80 S ribosomes remained the dominant species in most experiments.

Experiments designed to elucidate the fine structure of the spores at various stages of germination have met with only limited success. No information concerning cytoplasmic membranous structures has been obtained. However, it has been established that the spore wall consists of three layers. The outer layer is a dense fibrous material. The intermediate layer is considerably less dense and appears to be laminated. The inner layer is a dense granular material. It is suggested that the intermediate layer is responsible for the rigidity of the spore wall.

Microfilm \$2.75; Xerox \$5.60. 114 pages.

A STUDY OF THE PHYSIOLOGY OF HISTOPLASMA CAPSULATUM

(Order No. 61-2936)

Abolghassem Mahvi, Ph.D.
The University of Oklahoma, 1961

Major Professor: Howard W. Larsh

The mycelial phase of *H. capsulatum*, Ward strain, grew in extracts, of varying pH, prepared from chicken manure and various soil samples obtained from area around the chicken house.

The organism used most L-amino acids as a single source of nitrogen in a synthetic salt medium containing glucose as a source of carbon. It is plausible that the

amino acids were first deaminated and the organism then utilized the ammonia released to synthesize other amino acids necessary in protein synthesis. The amino acids were also used as carbon sources in the absence of glucose.

The organism used ammonium, but not nitrate nitrogen. It was postulated that *H. capsulatum* would synthesize all the amino acids for protein synthesis, through the reaction between ammonia and alpha-keto acids formed in carbohydrate dissimilation.

The results of carbohydrates utilization showed that the organism grew very well in mannose, glucose, and mannitol, but poorly in maltose, sucrose, and glycerol. Lactose, arabinose, xylose, lactate, pyruvate, and lower fatty acids did not stimulate growth.

Effect of various carbohydrates on the respiration of *H. capsulatum* indicate the presence of constitutive enzymes for mannose, fructose, maltose, and mannitol, since there was no lag phase in the initial rate of oxygen uptake. Lactose, arabinose, xylose, dulcitol, and sucrose did not stimulate oxygen uptake. Most of the fatty acids depressed respiration of *H. capsulatum*.

Most of the L-amino acids tested stimulated the oxygen uptake, except phenylglycine, alanine, and aspartic acid.

All the Krebs cycle intermediates, except cis-aconitic acid, stimulated the oxygen uptake, indicating a possibility of tricarboxylic acids cycle in this organism.

The cell free extracts of the mycelial and yeast phase were found to have an active hexokinase, phosphofructokinase, glucose-6-phosphate and 6-phosphogluconic acid dehydrogenase, aldolase, D-glyceraldehyde-3-phosphate dehydrogenase, 5-pentose isomerase, transketolase, and transaldolase. Most of the dehydrogenases were TPN specific. The results indicated the presence of both the Embden-Meyerhof and hexose-monophosphate shunt pathways in the mycelial and yeast phases of *H. capsulatum*.

Microfilm \$2.75; Xerox \$3.00. 47 pages.

TRANSDUCTION OF ANTIBIOTIC RESISTANCE IN *STAPHYLOCOCCUS AUREUS*

(Order No. Mic 61-2840)

Peter Arthur Pattee, Ph.D.
The Ohio State University, 1961

Various donor and recipient strains of *Staphylococcus aureus* were employed to transduce resistance to five antibiotics. The capacity to produce penicillinase, and resistance to chlortetracycline, novobiocin, erythromycin, and oleandomycin, were transduced. Attempts to transduce resistance to streptomycin were unsuccessful. The transducing phages were prepared by propagating phages 29, 52A, 79, 80, and 53 on strains of *S. aureus* which were resistant to one or more of the antibiotics employed. Each characteristic was transduced independently at an average frequency of five transductants per 10^7 phage particles employed when the multiplicity of infection was 1.0 or less. The transduced characteristics were stable, and joint transductions were not observed. Minor changes in the phage type of the recipient strains and the induction of lysogeny were occasionally observed after transduction.

The competence of the donor strains was limited by only two factors: possession of the characteristic to be

transduced and the ability to support the propagation of the transducing phage to titers of not less than 1×10^{10} plaque forming units per milliliter.

The competence of the recipient strains was closely associated with susceptibility to lysis by the groups of phage of the International Typing Series. However, a competent recipient strain could be either resistant or susceptible to lysis by the transducing phage. Lysis of recipient strains which were susceptible to lysis by the transducing phage was prevented by using brainheart infusion agar as the base of the selective medium.

Fourteen recipient strains accepted the markers determining resistance to penicillin, chlortetracycline, novobiocin, erythromycin, and oleandomycin. Only four recipient strains which were susceptible to the antibiotics employed and all of the "epidemic" strains which were examined accepted the markers determining resistance to erythromycin and oleandomycin at relatively high frequencies. Microfilm \$2.75; Xerox \$7.20. 153 pages.

**A TRANSDUCTION ANALYSIS
OF COMPLEX LOCI IN
*STAPHYLOCOCCUS AUREUS***

(Order No. Mic 61-2844)

Harry Leonard Ritz, Ph.D.
The Ohio State University, 1961

Ten tryptophan-requiring strains of *Staphylococcus aureus* were obtained from a tryptophan-independent strain by a technique which utilized the mutagenic action of ultraviolet irradiation and the bactericidal action of penicillin. Nutritional studies separated the mutants into two different phenotypic groups, which were designated tryA and tryB. The tryA mutants were capable of growth only when tryptophan was present in a minimal medium. The tryB mutants grew in the presence of either indole or tryptophan. Through syntrophism experiments, it was noted that the tryA mutants produced intermediates that would support the growth of all of the tryB mutants.

Transductional analyses were successful in determining the linkage relationships of the alleles represented by the various mutants. In addition to the use of comparative transduction frequencies of single markers for the determination of the order of the mutant sites, it was possible to map the mutant alleles by scoring donor type recombinants which occurred as a result of linked transductions. The seven tryB mutants were closely linked and well separated from the two tryA mutants. A tenth mutant, tryAB-12, was incapable of acting as a donor of tryptophan markers and could act as a recipient only when the wild type donor was used.

Differences in the frequencies of spontaneous reversion and in the frequencies of transduction with the wild type donor were noted among the various mutants.

Microfilm \$2.75; Xerox \$4.80. 95 pages.

PROPERTIES AND EPIDEMIOLOGICAL BEHAVIOR OF PORCINE ENTEROVIRUSES

(Order No. Mic 61-2850)

Karam Vir Singh, Ph.D.
The Ohio State University, 1961

The application of tissue culture technique has made possible the recognition of many enteroviruses--viruses whose primary habitat is the intestinal tract--from both the feces of man and animals. Therefore, current problems of the virologist are the characterization and identification of these enteroviruses, and the determination of their disease-producing potentials.

The purpose of this study was to describe some of the biological, physical, and chemical properties of a group of porcine enteroviruses isolated in our laboratory from the feces of swine, and tentatively designated Enteric Cytopathogenic Porcine Orphan (ECPO) viruses. Epidemiological behavior of these viruses in swine was also studied to explore whether the biological pattern in porcine species is similar to that of the human enteroviruses (Polio, Coxsackie, and ECHO) in man. Association of porcine enteroviruses with clinical disease was investigated by infecting experimentally specific pathogen-free (SPF) colostrum-deprived pigs.

Conventional tissue culture methods and the plaque technique, employing porcine kidney cells, were used for isolation, enumeration, and identification of these viruses. A study of the cytopathogenic effect (CPE) of porcine enteroviruses in tissue cultures derived from different species of animals indicates that these viruses are different from the other known viruses. Only ECPO-4 produced plaques on Philippine monkey kidney cultures. ECPO-4 virus agglutinated human group O and swine erythrocytes, whereas ECPO-2 and -5 agglutinated sheep erythrocytes in relatively low dilutions. The size of the ECPO-1 virus particle, as determined by electron microscopy, was 34-38 mu. ECPO-5 and -6 viruses were highly sensitive to dessication. Porcine enteroviruses and Infectious Canine Hepatitis virus were resistant to ether.

The infection of porcine enteroviruses is widespread in the swine population, as evidenced by the presence of neutralizing antibodies in porcine gamma globulin and by the frequency of isolation from feces. Human and bovine gamma globulin failed to neutralize porcine enteroviruses (ECPO-1, 2, 3, 4, and 5). The highest frequency of shedding virus was reached in pigs between nine and ten weeks of age.

Recurrent infection of the alimentary tract with different serotypes of porcine enteroviruses occurred in pigs raised under natural conditions. Certain types of ECPO viruses in feces of naturally infected pigs appeared and then disappeared. Alimentary infection elicited the development of specific neutralizing antibodies.

Neutralizing antibodies were not found in the serum of the newborn pigs prior to nursing, but were present in the serum in high titer within 28 hours after nursing. The persistence of passive antibody was directly related to the level of antibody titer at 28 hours after birth. Neutralizing antibodies were detected in the feces of young pigs nursing the sow. The high level of antibodies in colostrum would appear to have prevented the alimentary infection during the first few weeks of life.

There seems to be correlation between the passive

antibody titer at the time of infection and the development of active antibody response, viz., the lower the titer, the higher the active antibody response.

The oral administration of porcine enteroviruses results in an intensive viral multiplication in the intestinal tract, reaching the maximum between the third and seventh post-infection day, followed by gradual decline. Oral infection with porcine enteroviruses stimulated the development of type specific "local immunity" of the intestinal canal.

Homologous antibodies appeared between 14 and 21

post-infection days in sera of six-day-old SPF pigs. The presence of virus in blood on the fourth post-infection day suggests the vascular dissemination within the host. Attempts to detect copro antibodies in feces of SPF infected pigs were unsuccessful.

Simultaneous oral infection of two-day-old SPF pigs with ECPO-5 and -6 viruses produced clinical disease. High concentration of ECPO-6 virus was isolated from the CNS of a sick pig. Microscopic lesions consisted of non-suppurative encephalomyelitis.

Microfilm \$2.75; Xerox \$7.20. 152 pages.

BIOGRAPHY

NEW YORK PATRIARCH: A LIFE OF JOHN PINTARD, 1759-1844.

(Order No. Mic 61-2589)

David L. Sterling, Ph.D.
New York University, 1958

Adviser: Ray W. Irwin

Eighty-five years, 1759-1844, are a long time in American history. They begin in the middle of the French and Indian War, encompass two other conflagrations, and end at the approach of the war with Mexico. They are the life span of John Pintard, the subject of this first full-length biography. Pintard lived long and vigorously. He read voraciously; his interests were catholic; his activities and acquaintances were multiple. Cognizant of the importance of primary sources to future historians, he saved a plethora of personal letters and papers that reconstruct the content of his own life and relate him to his American environment.

John Pintard is an invaluable study for the historian. He knew and observed important men of his times. He lived through two American wars, saw the proposal, ratification, and expansion of the Union under the Federal Constitution, read the first ominous signs of disunion in the Missouri Compromise, and watched with growing anxiety the development of the slavery controversy. Not reticent, in fact a most open man, he recorded with an obvious relish his opinions of men and events on three levels of American political life.

This has been the backdrop of the biography. A part of the task has been to integrate the man into his environment, to show for instance what Pintard thought of the Federal Constitution, the Louisiana Purchase, the War of 1812, the election of Andrew Jackson. But John Pintard was much more than a spectator. Through his long life he contributed in small and large measure to numerous important

developments in national history. He acted as William Duer's principle agent in New York, was partly responsible for the panic of 1792, and learned forbearance and repentence in an eight-year exile and imprisonment in New Jersey. He visited New Orleans, campaigned as editor of the New York Daily Advertiser for the annexation of Louisiana, and advised Albert Gallatin on the government of the new territory. He embarked on a political itinerary which led from the republican who helped to organize the Society of St. Tammany and favored the ideas of the French Revolution, to the Federalist who damned the results of that cataclysm, to the Clintonian who assisted in the management of the presidential campaign of 1812, and finally to the nominal Whig who believed himself above the pettiness of partisan backbiting.

This is only one side of Pintard's activities and indeed it is the minor one. For Pintard's most important and most lasting contributions were made in the field of urban history to the cultural and economic prosperity of New York City. The list of associations to which he belonged and in which he worked is an almost unending one. A founder of the New York Historical Society and of the first savings bank in the city, treasurer of the American Academy of Fine Arts, secretary of the American Bible Society, he not only joined clubs but he proposed and worked for the realization of constructive projects. He held at different times during his life state and municipal office, serving in the New York Assembly, in the Common Council, and as New York's first City Inspector. He early understood the economic significance of the Erie Canal and joined with De Witt Clinton in the campaign for its construction. He was a passionate controversialist, a profoundly religious man who nevertheless believed in toleration, a philanthropist with an instinctive contempt for the lower classes. Never a great man in national affairs, in the singleness of his purpose, in the vision of his ideas, he approached greatness within the confines of the urban stage.

Microfilm \$5.10; Xerox \$18.00. 400 pages.

BIOLOGY—GENETICS

RECURRENT SELECTION AND INBREEDING FOR MATURITY IN MAIZE

(Order No. Mic 61-2682)

Alain Francois Corcos, Ph.D.
Michigan State University, 1961

Major Professor: E. C. Rossman

The relative effectiveness of continuous inbreeding with selection compared to three cycles of recurrent selection for corn maturity as measured by silking date was studied in populations derived from two double-cross hybrids and four single-cross hybrids.

Direct comparison in the nursery between recurrent and inbred series was difficult due to inbreeding depression which masked the effectiveness of the breeding methods. Decline in fertility and vigor and delayed maturity were among the general effects of inbreeding and are referred to as inbreeding depression.

Inbreeding depression affected the inbred series more than the recurrent selection series. In recurrent selection only one plant in each row was selected in order to maintain inbreeding pressure at a minimum. With inbreeding and selection, plants were selected within and among rows.

To overcome the effects of inbreeding depression, it was suggested that the recurrent selections should be inbred (without selection pressure for maturity) and compared with the inbred selections.

Nursery results indicated that both methods had been very effective in dividing the original F_2 material into two maturity groups and that fixation of genes was rapid. Fixation was very rapid in a population from an early-x-early single cross (1a. 153 x W25) and less rapid in a population from an early-x-late single cross (MS24A x L317).

In a corn breeding program, the ultimate objective is to utilize inbred lines in hybrid combination. Thus, evaluation of lines for maturity in testcrosses is possibly the best method to overcome the inbreeding depression effects which masked the effectiveness of the breeding methods when compared in the nursery.

Testcross results indicated that the early inbred series were earlier than recurrent series in two of the three cases, and the late inbred series were later than the recurrent series. However, the differences between the two series were very small indicating that the two methods were equally effective. Very rapid fixation of genes and equal effectiveness of the two breeding methods indicated that few genes for maturity were involved.

Lines that were both earlier and later in maturity than the parental lines of the original crosses were obtained in both recurrent and inbred series.

In all the testcross experiments there was a wide range for yield among the selections within a maturity group, indicating that selection for combining ability could be effective within the maturity groups.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

MICRURGICAL STUDIES ON THE NUCLEI OF AMOEBAE

(Order No. Mic 61-2595)

Elaine G. Diacumakos, Ph.D.
New York University, 1958

Adviser: Professor M. J. Kopac

The effects of several micrurgical procedures on the nuclei of Amoeba proteus, Amoeba dubia, and Pelomyxa carolinensis were evaluated in terms of changes in the structure of nuclei as revealed by supravital dyes and classical staining methods. Micrurgical procedures included nuclear puncture, impalement, enucleation, nuclear stretching (intra- and extracellular), and microinjection of oil drops and various aqueous solutions.

Supravital dyes, Methylene violet (Bernthsen), Acridine orange, and Methylene blue, were used as immersion media and were microinjected. It was found that intact amoebae do not become stained in the cytoplasm or in the nucleus. Damaged nuclei show striking color changes when the amoebae are immersed in supravital dyes or when these dyes are microinjected into the cytoplasm. If the amoebae are subsequently fixed in cold methanol, coloration is lost. If amoebae are fixed in cold methanol and then immersed in supravital dyes, striking coloration occurs. Since these dyes do not interfere with classical staining procedures, they permit subsequent manipulation so long as the nucleus is intact and permit the subsequent staining with other methods.

Methyl green-Pyronin Y was used to study the cellular changes induced by the micrurgical methods employed. Staining of individual amoebae permitted observation of the nuclei. In all instances where damage occurred, there was a loss of the characteristic pyroninophilic nucleolar architecture so that a hyaline sone in part of the nucleus permitted the site of damage to be located. This indicated disruption of the normal nucleolar architecture. Nuclear elements ordinarily stainable by Methyl green were not discernible, probably because of the unknown, and probably atypical, nucleolar-chromosomal organization of the nucleus in Amoebae.

Aceto-orcein-Fast green FCF mixtures were employed which, by virtue of their simultaneous fixing and staining properties, permit immediate observation of micrurgically-treated amoebae. Nuclear damage was reflected by striking color changes, i.e., the normal Fast green staining of the nucleoli was lost and diffuse magenta staining by Orcein was evidenced. Nucleoli of presumably intact nuclei become stained a magenta color when Orcein alone is applied. If Orcein and Fast green FCF mixtures are applied, then the nucleolar masses stain green, with certain salt concentrations. The oil capped nucleus stained with Aceto-orcein-Fast green FCF does not reveal characteristic fine structures which can be seen in intact nuclei. Oil capping of the amoebae and subsequent fixing and staining with these mixtures reveal the presence

of protoplasmic proteins at the periphery of the oil cap.

When intact amoebae were stained with Hematoxylin and Eosin, following fixation in cold methanol, the discrete nucleolar structures are stained by the Hematoxylin; the cytoplasm is clearly eosinophilic. There were no signs of eosinophilic structures in the nucleus. Amoebae exposed to ribonuclease solutions either by immersion or micro-injection were then stained with Hematoxylin and Eosin following cold methanol fixation. In the ribonuclease-treated amoebae, it was not possible to find the nucleus with any assurance. Amoebae immersed in ribonuclease solutions showed a 'boiling' effect which persisted for about 1 hour. Microinjection of ribonuclease solutions induced this effect quickly followed by violent disintegration of the cells.

The utilization of these various staining procedures concomitant with micrurgy provides an important approach to the evaluation of cell types which potentially may be subjected to more complex micrurgical procedures such as nuclear transplantation. Permanent preparations of individual micrurgically-treated cells provide an important means of evaluating the effects of micrurgical treatment on subcellular structures.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

THE BIOLOGY AND ECOLOGY OF THE
JACK-PINE BUDWORM IN WISCONSIN
WITH SPECIAL REFERENCE TO
INSECT PARASITES

(Order No. 61-2947)

John Charles Dixon, Ph.D.
The University of Wisconsin, 1961

Supervisor: Associate Professor Daniel M. Benjamin

For more than twenty-five years, the jack-pine budworm, Choristoneura pinus Freeman, has severely defoliated mature and overmature merchantable stands of jack pine in the Lake States. Outbreaks have occurred periodically at six to eight year intervals and persisted for two to four years. Substantial tree mortality and reductions in increment have occurred and many understory sapling and reproduction jack, red, and eastern white pines have been killed.

The recent outbreak of the budworm in Wisconsin began in 1952, built up rapidly, then collapsed in 1957 and 1958. In 1954 ecological studies of the jack-pine budworm were undertaken in cooperation with the Wisconsin Conservation Department and the Wisconsin Alumni Research Foundation.

Forty-six parasites were recovered from the jack-pine budworm in Wisconsin, including thirty-two primary parasites and six hyperparasites. The status of eight species could not be determined.

Apanteles fumiferanae Vier. and Glypta fumiferanae (Vier.) were the only species recovered from overwintering larvae. They attack the larvae in the fall and emerge the following spring. The budworm larvae were free from attack until the fifth and sixth instars, when they were infested by a group of dipterons, the most prominent of which

were Aplomya caesar (Ald.), Lypha setifacies (West.), and Phryxe pecosensis (Tns.). The most effective pupal parasites were Itoplectis conqueritor (Say), Phaeogenes hariolus (Cress.), Ephialtes ontario (Cress.), and Amblymerus verditer (Nort.). Trichogramma minutum Riley was the only egg parasite.

Apanteles, Itoplectis, and Trichogramma increased in effectiveness as budworm populations increased, and were important in bringing about the collapse of the outbreak in northwestern Wisconsin. Glypta and Phaeogenes did not react to changes in host populations. Ephialtes decreased in abundance as host populations increased. The influence of parasites associated with the budworm in Wisconsin was compared with that of species attacking the jack-pine and spruce budworms elsewhere in North America.

Jack pine stands in Wisconsin and Michigan containing 25 to 300 stems six inches d.b.h. and above per acre were severely defoliated by the budworm. Such stands are considered poorly stocked, and thus susceptible to outbreaks of the budworm. As the number of six inch stems per acre approached 400, vulnerability declined rapidly.

Mortality to merchantable, sapling, and reproduction jack pine as a result of budworm feeding have been moderate in Wisconsin. Top-killing occurred in some areas after two years of severe defoliation, but was generally moderate. Overmature stands were most likely to suffer mortality to merchantable trees and four-inch saplings. Orchard-type stands were most likely to suffer losses to reproduction.

Analyses of the budworm population densities in Wisconsin indicated that they were essentially the same in all stand types (overmature, young-vigorous, and orchard-type) in all life stages. All stages were distributed evenly throughout the crowns of the trees, except in the second instar which were concentrated in the upper crown shortly after emergence.

Correlation analyses failed to reveal relationships of predictive value between defoliation and the following life stages: overwintering larval, late larval, pupal, and egg. Relationships could not be demonstrated among populations as they passed from stage to stage. The incorporation of data on parasitism and hatching failure did not appreciably alter the correlation coefficients.

Microfilm \$2.75; Xerox \$8.40. 183 pages.

OBSERVATIONS ON THE BIOLOGICAL
EFFECTS OF IONIZING RADIATIONS
ON THE LIFE CYCLE OF
HETERODERA ROSTOCHIENSIS
WOLLENWEBER, 1923.

(Order No. Mic 61-2593)

George Fassuliotis, Ph.D.
New York University, 1958

Adviser: Dr. C. H. Willey

The biological effects of ionizing radiations have been investigated in the golden nematode, Heterodera rostochiensis, a parasite of potatoes and tomatoes. The resistant stage, the cyst, containing several hundred embryonated eggs, was irradiated with a G. E. Maxitron X-ray machine

set at 250 KVP and 30 ma. with 1/4 mm. copper and 1 mm. aluminum filtration at a distance of 17.5 cms. The dose rate was 1,000 roentgens per minute. In addition cysts were irradiated with a cobalt-60 gamma source emitting 670,000 roentgens per hour. All irradiations were carried out at the Brookhaven National Laboratory, Upton, New York. Moist cysts were placed in small plastic vials which were stoppered and treated at room temperature with dosages ranging from 5 through 1,280 kr.

The effects of irradiations on hatching and emergence of larvae from the cysts, infective capacity and reproduction of irradiated larvae were studied. In addition the possibility of parthenogenesis in the golden nematode was investigated and a comparison of the maturation divisions of oocytes from unirradiated females and in oocytes from females developing from irradiated larvae was attempted. The following observations and conclusions were made:

1. A delay of larval emergence was noted after 160 kr. and above, which also resulted in a significant decrease in total hatch.
2. A differential in radiosensitivity among embryo-nated eggs within the cysts is indicated. This may be related to a gradient of oxygen tension and post-irradiation storage at 40° F. Cysts placed in root leachings one week after irradiation resulted in normal hatching curves from cysts treated with 5, 10 and 20 kr. After 40, 80 and 160 kr., the peak of hatching was reached 11 days later. Irradiated cysts stored for one month at 40° F. prior to hatching the larvae, resulted in normal hatching curves from all irradiated cysts to 160 kr. After 320 kr., hatching was greatly reduced. No larvae hatched after a dose of 640 kr.
3. A disturbance in the normal pattern of motility of the emerged larvae in the form of slight jerkiness in their movements was first noted after 80 kr. At higher levels of irradiations this injury was accentuated.
4. Larvae in the eggs were killed after treatment with 640 kr.
5. After 20 kr., the infective capacity of the larva is decreased significantly. With increased doses of irradiation there was a decrease in infectivity. A few larvae were able to penetrate after 320 kr.
6. No significant differences were found in the number of eggs produced by unirradiated controls and by females from larvae irradiated up to 20 kr.
7. After 20, 40 and 80 kr. eggs in females developing from irradiated larvae contained 16, 2 and 0 per cent embryonated eggs. However, no larvae hatched from the 20 and 40 kr.-females.
8. Viability was not altered in developing females following postirradiation storage for 6 months at 40° F. No differences were observed between these and larvae inoculated soon after irradiation.
9. The male was found to be essential for reproduction. Parthenogenesis does not occur in this nematode. In 'single larva' inoculations of tomato roots developing females did not contain any unfertilized eggs.

10. There are indications that the presence of sperm is essential for the release and maturation of the oocytes.
11. Transformation of white females to brown cysts is dependent upon fertilization and egg production. Prolonged periods between these color changes were observed in females developing from irradiated larvae and in unfertilized 'single larva' females.
12. A diploid number of 18 chromosomes has been counted in the oocytes.
13. Chromosome aberrations were found in eggs recovered from females that developed from irradiated larvae. These were in the form of fragments and bridges at anaphase.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

**AN IMMUNOGENETIC ANALYSIS
OF WHITE VARIEGATED POSITION EFFECTS
IN DROSOPHILA MELANOGASTER**

(Order No. Mic 61-2692)

Kathryn Elizabeth Fuscaldo, Ph.D.
Michigan State University, 1961

Major Professor: Allen S. Fox

The white variegated position effect was analyzed immunologically to determine the effect of eu-heterochromatic rearrangements on protein structure and specificity. Stocks were used which contained the inversion, In (1) w^{m1} , a derivative, In (1) $w^{m4}w$ and a translocation, T(1:4) w^{m5} . The mutants w , w^e , w^{a2} and bw cn were also tested along with Oregon-R-I. In all cases an alteration of the heterochromatic relationship to the white locus resulted in a change in the form of an antigen, designated H(w)-1.

Agar-diffusion techniques were employed to determine the antigenic specificities present in all of the stocks. The antigen H(w)-1 exhibits a higher combining power in the inverted and translocation stocks than in the wild and mutant stocks. The difference is most probably associated with a difference in the number of combining sites on the antigen along with a difference in the configuration of the antigenic site.

This alteration in the immunological properties of an antigen without a change in its specificity is associated with the disturbance of the normal euchromatic-heterochromatic balance in the cell. It is suggested that heterochromatin is involved in the final stages of protein synthesis and more particularly in determining tertiary structure of the protein. The primary structure, that is the sequence of amino acids, is controlled by the individual, euchromatic, loci. An array of potential tertiary configurations is possible for each primary structure but the final configuration which confers absolute specificity on the protein is imposed at a later stage under the control of the heterochromatic regions.

Microfilm \$2.75; Xerox \$3.00. 51 pages.

**STUDIES ON THE SEA URCHIN EGG NUCLEUS:
ITS ISOLATION, STRUCTURE, PHYSICAL
PROPERTIES AND DNA CONTENT.**

(Order No. Mic 61-2672)

Ralph T. Hinegardner, Ph.D.
University of Hawaii, 1961

A method for isolating large numbers of nuclei from mature eggs of the sea urchin Echinometra mathaei (Blainville) is described. This involves: 1) cleavage of the eggs into two halves by high speed centrifugation, 2) homogenization of the nucleated halves in sea water by forcing them rapidly through a #20 hypodermic needle, 3) removal of the large debris by filtration through absorbent cotton and 4) separation of the nuclei from the rest of the homogenate by slow speed centrifugation over isotonic sucrose solution. The yield is about 12% and contamination amounts to about 10% by volume. The physical changes undergone by the nucleus during isolation are also discussed.

Nuclei of E. mathaei possess a nucleolus-like body that is only visible after high speed centrifugation or when the whole egg is ruptured in a solution containing no NaCl. Some of the physico-chemical properties of this body are described.

The appearance of the nucleoplasm undergoes a number of characteristic changes when the nucleus is released from the egg. These changes were found to be dependent on the ions present in the surrounding medium. Calcium and magnesium tend to give the nucleoplasm a reticular appearance, while sodium is antagonistic to these two ions and causes the nucleoplasm to appear homogeneous. When neither calcium nor magnesium are present, the nucleus becomes very fragile and seems to lose its contents.

The deoxyribonucleic acid (DNA) content of the isolated nuclei was measured by the Dische diphenylamine reaction and by microbiological assay utilizing a nucleotide requiring mutant strain of Lactobacillus acidophilus (ATCC 11506). The description of the latter method of analysis includes several modifications from the published procedures. Both thymidine and purified DNA were found to be inaccurate standards, but the sperm of E. mathaei was found to be suitable. The measured DNA content of the sperm was about 0.84×10^{-12} gm per cell. The isolated nuclei were found to contain 0.89×10^{-12} gm of DNA. This amount is close enough to that found in the sperm to support the conclusion that the mature egg nucleus, like the sperm cell, contains the haploid amount of DNA.

This conclusion is qualitatively supported by controlled Feulgen staining of the egg nucleus. The nucleus is rendered unequivocally Feulgen positive by treating the nucleated egg halves with hypertonic NaCl solution prior to fixation. This reduces the volume of the nucleus and the DNA containing nucleoplasm is condensed into easily seen globules.

A new method for inducing sea urchin spawning with the use of .01M acetyl choline in sea water is also described. Microfilm \$2.75; Xerox \$6.20. 130 pages.

**THE NATURE OF TUMOR DEVELOPMENT
IN THE tu-e STRAIN OF
DROSOPHILA MELANOGASTER: THE ROLE
OF NUTRITIONAL MODIFICATION AND
TEMPERATURE VARIATION IN THE
TUMOR PROCESS.**

(Order No. Mic 61-2598)

Martin Lee Kaplan, Ph.D.
New York University, 1958

Adviser: Professor Morris H. Harnly

The purpose of this investigation was twofold: 1) to obtain information on the nature of tumor cell production, tumor localization, and tumor differentiation in tu-e larvae, and 2) to explore the relative value of histological analysis in studying the tumor process in the tu-e strain. Larvae of the tumorous tu-e strain and larvae of the non-tumorous wild 51-52 stocks of Drosophila melanogaster, were subjected to diets containing indoleacetic acid in conjunction with modifications in the environmental temperature. A series of larval-extract-injection experiments also were performed to study the factors involved in the inhibition of tumor production. Much of the data are based on histological analysis. This is a departure from the traditional method of counting 'black-spots', and provides more insight into the nature of the tumor process in Drosophila.

Spindle cell tumors similar to those normally found in tu-e larvae were induced in all injected host (wild 51-52) larval groups regardless of the diet on which donor larvae (tu-e) or host larvae were raised. The tumor frequency, however, varied with the nutritional state of the donor as well as of the host larvae. It is concluded that the nutrition of the host larva is an important factor in the production of tumorous spindle cells. It is suggested that the degree of spindle cell production is dependent on the titer of active tumor inducing factor, as well as the competency of the reacting cells.

In tu-e larvae, the chief sites for tumor localization are the hemolymph and the abdominal pericardial area. Interference with tumor localization was obtained in tu-e larvae with all dosages of indoleacetic acid included in the diet. When the experimental diets were used, the percentage of unattached tumors in the hemolymph remained stable, whereas reductions were obtained in the frequency of abdominal pericardial area tumors. It is concluded that indoleacetic acid affects tumor site localization indirectly by interfering with the general developmental rate of the larva.

The stages of tumor differentiation were consistent with the observations reported in previous studies. Differing rates of tumor differentiation, however, were noted when indoleacetic acid was added to the diet. It is concluded that the rate of tumor differentiation is directly dependent upon the substrates available for the completion of the process of tumor differentiation rather than on the over-all rate of growth of the larva. Data obtained from temperature studies suggest that apparent temperature effects on tumor differentiation may in actuality, be a manifestation of altered nutritional processes.

Larval uptake of indoleacetic acid resulted in the appearance of melanin pigment in the hindgut epithelium in both tu-e and 51-52 larvae. It is demonstrated that these melanized structures could be mistaken for melanized

spindle cell tumors unless histological examination is included in the analysis. It was found that the study of larvae in section provided a more accurate appraisal of the presence of amelanotic tumors in apparently non-tumorous larvae. It is suggested that information based on 'black-spot' tumor counts generally obtained by dissection of either the larvae, pupae, or adults could conceivably result in misinterpretations of experimental data, unless the data is complemented by histological analysis.

The possible relationship between the metabolism of tryptophan and the tumor process is discussed. It is suggested that the tryptophan pathway(s) associated with melanoma production in *Drosophila melanogaster* may be directed at the differentiation phase of the tumor process. Suggestions are made concerning possible approaches for obtaining more direct evidence of the complicity of tryptophan in development.

Microfilm \$2.75; Xerox \$7.40. 157 pages.

**STUDIES ON CHLOROPHYLL SUPPRESSORS
AND THE HORN-LIKE (hc) COLEOPTILE
MUTANT IN *ZEA MAYS* L.**

(Order No. Mic 61-2439)

Bhag Singh Sidhu, Ph.D.
Cornell University, 1960

Part A

The complexity in chloroplasts pigment inheritance is classically referred to 'multigenic inheritance' and several attempts have been made to study this problem from various aspects. The work discussed herein, is another approach toward an understanding of the problem.

Studies were conducted on several non-allelic pleiotropic genes $Lw_1\ lw_1$, $Lw_2\ lw_2$, $Cl_1\ cl_1$, $W_3\ w_3$ and $Ps\ ps$ which in the homozygous recessive state result in light endosperm and albino seedlings. These five stocks were outcrossed to open pollinated varieties Cornell 11 and Minnesota 13. F_1 crosses were selfed and segregations of kernel colors and seedlings were recorded. This technique enables the isolation of S_{lw_2} (partial chlorophyll suppressor of $lw_2\ lw_2$), S_{ps} (complete chlorophyll suppressor of $ps\ ps$), and S_{cl_1} (partial chlorophyll suppressor of $cl_1\ cl_1$ possibly allelic to cl_3).

In order to study the epistatic effect among these pleiotropic genes intercrosses were made and Cl_3 (a complete chlorophyll suppressor of $cl_1\ cl_1$, provided by Dr. Everett), was crossed to $Lw_1\ lw_1$, $Lw_2\ lw_2$, $Cl_1\ cl_1$, $W_3\ w_3$ and $Ps\ ps$. A genetic model for the Cl_3 suppressor gene action was constructed. The segregation data while not entirely

conclusive favours the interpretation that Cl_3 cannot suppress $lw_1\ lw_1$, $lw_2\ lw_2$, $w_3\ w_3$ and $ps\ ps$.

The partial chlorophyll suppressor $S_{lw_2}\ S_{lw_2}$ was studied in comparison with $Lw_2\ Lw_2$ (normal) and $lw_2\ lw_2$ (albino) under blue, white and red light environments superimposed on sand culture of seedlings grown in different nutrient combinations. It was determined that Lw_2 in homozygous or heterozygous in white light $>$ red light $>$ blue light. $S_{lw_2}\ S_{lw_2}$ in blue light $>$ white light $>$ red light. The results were established via absorption spectra and color chart comparison values.

S_{cl_1} suppressor in the heterozygous condition was pale green but turned darker green when supplied with complete Hoagland's nutrient solution.

Microscopic observations of plastid morphology in living tissue following Randolph's (1922) technique and in the material fixed in Zirkle's plus pyridine fixative, sectioned and stained with Heidenhein's iron-alum haematoxylin (Johansen, 1940), were carried out in the five major gene types for normal green, albino and suppressors (wherever isolated). In the seedlings of the stocks Pastel Pioneer, Pastel-8686 and Pastel-4889 chloroplast size, shape and pigment intensities in living tissues have been measured. The most common shape of chloroplasts uniformly was found as circular (2-3 u) and maximum size was attained within one week in the growth chambers.

The phenotypic greenness in the leaves is seen to be due to numbers of chloroplasts per cell as well as to the quantity of pigmentation in each one of them. Partial suppressors showed a wide range of pigmentation in the chloroplasts of even a single cell. A simple enlargement of proplastids was determined to be the major element of chloroplast development.

Part B

The morphological nature of the grass coleoptile remains an undecided issue in spite of the fact that several viewpoints have been presented from time to time. This section deals with the genetics of recessive mutants affecting coleoptile type, with special reference to the horn-like coleoptile mutant.

Morphology, anatomy and inheritance of this spontaneously occurring single gene recessive mutant (horn-like coleoptile) is discussed and a preliminary comparison of endogenous growth substances is made in *Hc* and *hc* seedling coleoptiles at one and two week growth stages.

A hypothesis is presented to relate gene controlled links between the normal leaf and the coleoptile. The idea that the classical grass coleoptile is a modified leaf has been supported and the evolutionary links have been reconstituted by way of gene controlled mutants in maize. Thus, the idea finds support from *hc*, *ac* and Bianchi's Bikeeled mutant forms. A further step which is considered likely points to the coleoptile as two fused and reduced leaves rather than a single leaf.

Microfilm \$2.75; Xerox \$6.40. 134 pages.

BOTANY

AUTORADIOGRAPHIC STUDIES OF NUCLEOPROTEIN METABOLISM DURING THE DIVISION CYCLE

(Order No. Mic 61-2659)

Deepesh Narayan De, Ph.D.
Columbia University, 1961

With the aid of tritiated thymidine and tritiated amino acids, arginine and tryptophane, the pattern of histone and nonhistone synthesis in relation to DNA synthesis in the mitotic cells of onion root tip and meiotic cells of Tradescantia, was studied. The protein fraction, soluble in 1/100 N HCl at 25°C after removal of nucleic acids from tissues fixed by freezing-substitution in methanol, is operationally defined as histone. The protein fraction left in tissue sections after removal of nucleohistone is designated nonhistone.

The present investigation shows that histone is actually synthesized in chromatin concurrent with the replication of DNA during interphase in the cells of onion root tip. The chromatin also accumulates considerable amounts of nonhistone and some histone during the post-DNA-synthetic period. The nucleolus accumulates no detectable histone and very little nonhistone during the DNA-synthetic period. However, during the post-DNA-synthetic period the nucleolus rapidly accumulates both histone and nonhistone.

At the early leptotene stage of the microsporocytes the chromatin produces both DNA and histone. The cytoplasm and the nucleolus appear to produce nonhistone. This synthetic pattern is followed by an increased rate of nonhistone synthesis in the chromatin and the nucleolus. The pattern of nucleoprotein synthesis by the tapetal cells is similar to that which was observed in microsporocytes at leptotene. The cytoplasm of the microsporocytes accumulates nonhistone from zygotene onwards, but no detectable histone.

To study the nucleolar protein turnover, dilution experiments were carried out. Onion root tip cells were treated with tritiated amino acids for 1 hour and then transferred to a nutrient solution with an excess of unlabeled amino acid. The distribution of labeled histone and nonhistone of post-DNA synthetic interphase cells was studied. Both labeled histone and nonhistone proteins were lost from the nucleolus, that is, diluted by the unlabeled proteins. These losses were accompanied by increase in labeling in the chromatin in case of histone and in both chromatin and cytoplasm in case of nonhistone.

Microfilm \$2.75; Xerox \$3.00. 57 pages.

CONTRIBUTIONS TO THE FOSSIL FLORA OF THE ONTEORA "RED BEDS" (UPPER DEVONIAN) IN NEW YORK STATE.

(Order No. Mic 61-1432)

Francis Maurice Hueber, Ph.D.
Cornell University, 1960

The Onteora "red beds" represent the continental phase of the lower Upper Devonian in the Catskill Mountains of eastern New York. Fossil plants occur as compressions or petrifications in localized deposits in the beds.

Collections were made at four localities ranging from lowermost Onteora into the middle Onteora.

Eleven genera are described of which three are new. Two new species are proposed for previously established genera.

A complete listing of the flora as presently known is divided as follows: Part I, plants described in the present dissertation; Part II, plants described by the writer in a preliminary survey which are different from those in Part I; Part III, plants listed from the Onteora but not found by the writer; Part IV, plants from marine equivalents which can be expected to occur in the Onteora; Part V, plants from continental equivalents to the Onteora.

Part I. Hepaticites devonicus sp. nov. Serrulacaulis furcatus gen. et sp. nov. Pseudosporochnus sp. Potonié and Bernard 1904. Astrostyloxyton Davidii (Harris) nov. comb. Cladoxylon dichotomum sp. nov. Cladoxylon sp. Unger 1856. Bertrandia tetralobis gen. et sp. nov. Aste-ropteris noveboracensis Dawson 1880. Actinopodiopsis haskinsii gen. et sp. nov. Tetraxylopteris schmidii Beck 1957. Eospermatopteris erianus (Dawson) Goldring 1924. Callixylon zalesskyi Arnold 1930 (stem).

Part II. Drepanophycus gaspianus (Dawson) Kräusel and Weyland 1948. Colpodexylon sp. Banks 1944. Cladoxylon onteorense sp. nov. Aneurophyton hallii (Dawson) Arnold 1940. Callixylon petryi Beck 1953 (root).

Part III. Archaeopteris halliana (Goeppert) Dawson 1871. Archaeopteris obtusa Lesquereux 1880.

Part IV. Lepidosigillaria whitei Kräusel and Weyland 1949. Archaeosigillaria vanuxemi Kidston 1901. Cyclostigma affine Dawson 1881. Tasmanites huronensis (Dawson) Schopf, Wilson and Bentall 1944. Cladoxylon dawsoni (Dawson) Read 1935. Dadoxylon clarkii Dawson 1882. Dadoxylon sp. Endlicher 1847. Ormoxylon Dawson 1871.

Part V. Taeniocrada decheniana (Goeppert) Kräusel and Weyland 1930. cf. Sciadophyton laxum (Dawson) Steinmann 1929.

The discovery of Hepaticites in the Onteora establishes the earliest record of the Hepaticae.

Cladoxylon dichotomum sp. nov. has several similarities to Pseudosporochnus, however no lateral appendages have been found in organic connection with the axis.

Serrulacaulis furcatus gen. et sp. nov. is tentatively classed with the Psilophytalea on the basis of its simple structure.

It is suggested that Bertrandia tetralobis gen. et sp. nov., on the basis of its size and shape is the lateral appendage of Astropteris. Bertrandia is classed with the Zygopteridaceae of the Coenopteridales.

Actinopodiopsis haskinsii gen. et sp. nov. is established for fertile axes in which the anatomy of the laterals strongly suggests that of Actinopodium Høeg 1942. Grossly the morphology of the axes is suggestive of Archaeopteris, however the fertile appendages (pinnules) are spirally arranged on the laterals (pinnae).

Astrostyloxyton is the new name proposed for Schizopodium Harris 1929 which is shown to be a later homonym of Schizopodium Morièr 1888.

The ranges of the Middle Devonian genera Eospermatopteris, Pseudosporochnus and Astrostyloxyton nom. nov. are extended into Upper Devonian.

The discovery of Callixylon zalesskyi and Callixylon petryi conclusively establishes the area of the Onteora as the source of the Callixylon found in the marine equivalents in central and western New York.

The Onteora flora is interpreted as partially transitional on the basis of the occurrence of Middle Devonian genera, associated with the Upper Devonian genera Archaeopteris and Callixylon. The flora is also considered intermediate in that it possesses a large number of fern-like genera which form a "fern complex" from which later forms could have evolved, i.e. the true ferns and the pteridosperms.

There is an obvious lack of many lycopod genera as compared with other Devonian floras of the world.

A very large assemblage of spores has been isolated but set aside for later study.

Microfilm \$2.80; Xerox \$9.90. 216 pages.

THE STRUCTURE AND PATTERN OF THE PRIMARY FORESTS OF ATHENS AND WASHINGTON COUNTIES, OHIO.

(Order No. Mic 61-2847)

Richard Blaine Rypma, Ph.D.
The Ohio State University, 1961

The present study is a contribution to the major program of describing and mapping the primeval vegetation of Ohio, which has been carried out by the Botany Department of the Ohio State University. The study area includes 1141 square miles of extremely complex topographic area, with a very complicated vegetational history and an extremely complex environmental pattern.

For the purpose of this study the region has been divided into four areas based upon the general physiography and vegetation. No one of these areas is vegetationally distinct from the others, and in large part the same plant communities occur in them. The primary factor in the distribution of plant communities in this area appears to have been, and remains today, the character of soil moisture and its relationship to topography, slope exposure, degree of dissection and history of the land surface, and the underlying substrate.

No evidence has been found of a general successional climax community in this area, the vegetation having probably developed dynamically as a mosaic pattern of associations. There is no evidence to indicate that without a change in the macroclimate or in the existing plateau structure there was necessarily any marked change in the general structure of the secondary forests from the primary forests and, therefore, within certain limits the secondary forests could be used in conjunction with the original surveys as a reliable index to the general character of the primeval forest.

The principal upland forest associations included Oak-Pine, Oak-Chestnut, Mixed Oak, Oak-Hickory, Oak-Tuliptree, Oak-Hickory-Tuliptree, Mixed Mesophytic, White Oak-Beech-Sugar Maple, White Oak-Beech, Beech-Sugar Maple-Tuliptree, and Beech-Sugar Maple. Relict communities of prairie species, White Pine, and Hemlock were also present in the area. The principal Swamp Forest associations included Willow, Willow-Poplar-Soft Maple, Willow-Sycamore-Soft Maple, Elm-Sycamore-Soft Maple, Elm-Ash-Soft Maple, Mixed Swamp Forest, and Beech-Sugar Maple. Microfilm \$2.75; Xerox \$8.40. 182 pages.

CHEMISTRY

CHEMISTRY, GENERAL

A CHEMICAL STUDY OF HAWAIIAN MAGMATIC GASES

(Order No. Mic 61-2671)

Emerson Francis Heald, Ph.D.
University of Hawaii, 1961

I. An Investigation of the Applicability of the Vacuum Fusion Technique to the Determination of the Oxidation State of the Elemental Constituents of Rocks.

It is known that the partial pressure of O₂ in a gas mixture equilibrated with a molten iron silicate, as occurs in a magma, controls the oxidation state of Fe in the melt. In an attempt to relate the composition of gases dissolved in the melt to the oxidation state of Fe, the technique of vacuum fusion was applied. A series of vacuum fusion determinations were made on a sample of Fe₂SiO₄ which had been equilibrated with a mixture of CO₂, CO and Ar, fixing the partial pressure of O₂ at a very small value. The extracted gases turned out to be of extremely variable composition, containing large amounts of O₂. The presence of O₂ is attributed to the dissolving of Fe in the Pt crucibles used, shifting the equilibrium FeO = Fe + $\frac{1}{2}$ O₂ in the direction of more O₂. The varying extent of reaction of O₂ with the other gases then accounts for the poor precision. It is concluded that in order to make vacuum fusion a workable method for determining the oxidation state of the elements in a rock, it is necessary to eliminate such side reactions with crucible materials.

II. A Chemical Study of the Gases of Kilauea Volcano.

A study was made of volcanic gases collected during the 1959-60 eruption of Kilauea on the island of Hawaii. A new technique, based on the adsorption of gases by silica gel, was used in the collection of samples. The samples were analyzed by gas chromatography and were found to be principally H₂O and CO₂, with lesser amounts of SO₂, H₂S, H₂, N₂, CO and CH₄. Complex equilibrium calculations were carried out on the IBM 650, using a general method of minimizing the free energy. A study was made of the equilibrium variation of a typical volcanic gas phase with temperature, pressure, oxidation state and water content. A graphical method, similar to logarithmic pH diagrams, was developed to systematize the variation of a volcanic gas with oxidation state. Comparison of the analyses of samples collected at Kilauea Iki and Kapoho with the calculated equilibrium composition at the temperature of collection indicated that the volcanic gases do not reach equilibrium with surface contaminants such as ground water. A similar comparison on samples collected at the solfataric fumarole Sulphur Banks showed the latter to be in equilibrium, presumably because mixing with water

occurred at greater depths. The presence of increased amounts of sulfur in the form of H₂S was noted in the Sulphur Banks gases prior to and during the eruption. This is attributed to increased degassing of the magma, minimizing contamination of the gases. A consideration of the various substances contaminating volcanic gases leads to the conclusion that the primary magmatic gas is more reduced, and contains less H₂O and more sulfur gases than any of the samples collected during the recent eruption. Microfilm \$2.75; Xerox \$6.00. 122 pages.

CHEMISTRY, ANALYTICAL

SULFONATED DERIVATIVES OF 1,10-PHENANTHROLINE.

(Order No. Mic 61-2254)

David Elmer Blair, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Harvey Diehl

4,7-Diphenyl-1,10-phenanthroline (bathophenanthroline) and 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (bathocuproine), highly sensitive but water-insoluble colorimetric reagents for iron and copper respectively, have been sulfonated and water-soluble products of equal sensitivity obtained. The products proved to be disulfonic acids as shown by ultimate analysis and equivalent weight determinations.

The absorption spectra, molar extinction coefficients, and combining ratios of both the red ferrous derivative of bathophenanthrolinedisulfonate and the orange cuprous derivative of bathocuproinedisulfonate were obtained in water solution. The pH stability of both derivatives was determined as well as the effect of a large number of cations and anions upon the determination of iron using bathophenanthrolinedisulfonate and copper using bathocuproinedisulfonate.

The formal reduction potential of the ferric-ferrous-trisbathophenanthrolinedisulfonic acid couple was determined in both 1 M sulfuric and 1 M perchloric acids by potentiometric methods. The derivative was found to function well as a water soluble indicator, even in the presence of the perchlorate ion. The analysis of a number of iron ores was successfully performed using perchloratoeric acid as the titrant and ferrous trisbathophenanthrolinedisulfonic acid as the indicator.

The spectrophotometric analysis of iron and copper in yeast, following a wet ashing of the organic material utilizing perchloric acid, was accomplished using

bathophenanthroline disulfonate and bathocuproine disulfonate respectively. The analysis was performed in the presence of an excess of perchloric acid.

Sulfonation of 1,10-phenanthroline was also accomplished. Under the drastic conditions needed for sulfonation (fusion with ammonium acid sulfate at 365°) a number of sulfonated products were obtained.

A mixture of uncharacterized 1,10-phenanthroline-disulfonic acids were obtained. As shown by equivalent weight determinations and ultimate analysis, two mono-sulfonated 1,10-phenanthrolines were isolated in pure form. The materials were shown to be 1,10-phenanthroline-5-sulfonic acid monohydrate and 1,10-phenanthroline-3-sulfonic acid.

The sulfonated materials were observed to fluoresce and the yields obtained, melting points, and solubilities were determined for the monosulfonated compounds.

The absorption spectra, molar extinction coefficients, combining ratios, and pH stabilities were determined for the ferrous derivatives of both 1,10-phenanthroline-5-sulfonic acid and 1,10-phenanthroline-3-sulfonic acid. The stabilities of both iron derivatives in basic solution was found to be greater than the ferrous derivative of the parent 1,10-phenanthroline.

The formal reduction potential of both ferrous derivatives was determined in both 1 M sulfuric and 1 M perchloric acids and the formal reduction potentials were found to be considerably higher than the iron derivative of the parent compound. Sulfonation also causes the ferrous derivatives of both sulfonated materials to be soluble in the presence of the perchlorate ion as contrasted to the insoluble nature of ferrous-1,10-phenanthroline in the presence of perchlorate.

Microfilm \$2.75; Xerox \$5.40. 107 pages.

MECHANISMS OF ELECTROCHEMICAL REDUCTION OF CONJUGATED DOUBLE BOND SYSTEMS

(Order No. Mic 61-2755)

Philomena Gloria Grodzka, Ph.D.
University of Michigan, 1961

Considerable attention has been given in the literature to the search for correlations between polarographic half-wave potentials and various structural and kinetic parameters of compounds containing conjugated double bonds. Most correlations, however, have been based on electrochemical reduction mechanisms which are questionable because either the effects of experimental variables were not fully considered or the mechanisms were deduced from insufficient experimental data. The present study was undertaken to elucidate the electrochemical reduction mechanisms of thenoyl trifluoroacetone and the series of compounds, styrene, stilbene, 1,1-diphenylethylene, triphenylethylene and tetraphenylethylene. All of these compounds contain conjugated double bonds and, hence, provide a basis for future correlations of $E_{\frac{1}{2}}$; a by-product of such an investigation would be the development of a rational basis for the analytical determination of the compounds mentioned.

The first part of the dissertation is devoted to the cor-

relation of the observed polarographic behavior of the β -diketone, thenoyl trifluoroacetone (TTA), with its tautomeric and acid-base equilibria; the second part deals with an investigation of the rate-controlling processes in the polarographic reduction of the phenyl-substituted ethylenes and the determination of the corresponding heterogeneous rate constants and transfer coefficients (αn_a values).

The electrochemical behavior of TTA in aqueous buffered solution was investigated by means of conventional direct current polarography, coulometry, controlled-potential electrolysis and spectrophotometry. TTA gives four polarographic waves over the usual pH range, whose presence and properties depend upon pH, the specific buffer used and buffer component concentration. The report of only two TTA waves in a previous study is due to the large pH intervals between measurements. Spectrophotometric examination of TTA solutions, before and after controlled potential electrolysis at a massive mercury cathode, made possible an explanation of the complex polarographic behavior on the basis of the various tautomeric and acid-base equilibria involving TTA species, including assignment of the polarographic waves to the various TTA species present. Spectrophotometry indicates that the variations observed in the polarographic behavior of TTA in different alkaline buffers is probably due to specific catalytic effects of buffer components upon the specific rate constants for the conversion of ionized, nonreducible (at the potentials involved) TTA species to unionized, reducible species and not to borate complexation as previously suggested.

In the phenyl olefin study, the variations of criteria of reversibility for electrochemical reduction, previously developed for simple inorganic systems such as current dependence on mercury column height, the ratios of average to instantaneous currents and log plot slopes, were theoretically considered for various possible reduction mechanisms. These criteria of reversibility mentioned were then experimentally determined for the phenyl-substituted ethylenes in dimethylformamide containing 0.2 M tetrabutylammonium iodide, using direct current polarography. Heterogeneous rate constants and αn_a values were calculated on the basis of the spherical expanding electrode theory.

None of the reversibility criteria predictions for the various possible mechanisms are entirely in accord with the experimental results. Although polarographic reduction of the phenyl-substituted ethylenes is indicated to occur by processes which involved a change of electron transfer mechanisms, a definite decision regarding the actual mechanisms cannot be reached because of the lack of adequate theoretical bases for such a mechanism change and for the effects of variations in double layer structure on any given mechanism. The present study thus emphasizes the futility of applying directly criteria of reversibility postulated for simple inorganic systems to complicated organic systems.

Microfilm \$2.75; Xerox \$5.60. 114 pages.

TOPICS IN SOLVENT EXTRACTION

(Order No. Mic 61-1995)

George Webster Latimer, Jr., Ph.D.
Princeton University, 1960

Three aspects of the field of solvent extraction are presented in this work: (1) a study of the extraction of various metals from HCl using 1 - 4 butane dinitrile as the extracting solvent; (2) the distribution of ion-pair complexes, metal chelates, and iodine between immiscible non-aqueous solvents; (3) the synergic effect which mixtures of different halogenated hydrocarbons exert on the extraction of Al 8 - quinolate. All three subjects were undertaken with a view to understanding more fully the general principles underlying the processes involved in distribution phenomena.

The extraction of Fe(III), Mo(VI), and V(V) from aqueous HCl using 1 - 4 butane dinitrile is the first comprehensive study made of a system involving a non-oxygen containing organic solvent. The formulae for the extractable species are $(HFeCl_4)_n$, $(MoO_2Cl_2 \cdot HCl)_n$, $(HVO_2Cl_2)_n$ - n being greater than one for $(HFeCl_4)$ and very probably so for the others. This system has shown itself to be less discriminatory, but more effective than the solvents generally used for the extraction of these metals. The experimental evidence has also been used to test conclusions drawn from studies of oxygen-containing compounds for general applicability. In these systems the evidence will not support (1) the classical explanation advanced for the behavior of the extraction curves at high hydrochloric acid concentrations, (2) the concept that the extractable species is necessarily a strong acid, (3) the suggestion that the "polymeric" species is not a true polymer, but exists rather as ion clusters. An explanation of the behavior of the extraction curves is offered which provides a unified explanation for many systems studied.

Extraction studies using various different immiscible solvent pairs have been carried out. The distribution of ion-pairs between formamide and ethyl, isopropyl, or β , β' dichlorodiethyl ether; between 1 - 4 butane dinitrile and the same ethers; or between ethanolamine and these same ethers is almost exclusively in favor of the non-ethereal solvent. This behavior can be attributed to the strong Lewis base nature of the functional groups in these molecules and to the fact that the maximum acidity attainable in these systems is far lower than that which can be achieved in the corresponding aqueous - organic system. The distribution of metal chelates in formamide - chloroform systems shows definite fractionation only in the case of the dithizonates and diphenylcarbazides. This behavior can be attributed to an inability to vary the "pH" of the system since experiments involving a rather crude manipulation of this quantity do show definite separation patterns. Many of these extraction experiments were not reversible i.e., a solution of a metal salt in formamide equilibrated with a chloroform solution of the chelating agent did not give results comparable to those obtained when a chloroform solution of the chelate was equilibrated with pure formamide. This latter phenomenon arises from the fact that the "pH" in the former case was not comparable to that in the latter; metal salts dissolved in formamide are extensively solvolyzed. The behavior of iodine in systems involving formamide - chloroform and carbon tetrachloride - 1, 4 butane dinitrile arises from the strong

addition compounds formed between the iodine and the formamide and the nitrile.

Mixtures of chloroform or methylene chloride in carbon tetrachloride prove more effective or at least as effective as the most efficient member of the mixed solvent. This behavior is apparent even at low volume fractions of the more effective solvent. Such an effect is readily explained by postulating the formation of a hydrogen bond between the solvent and the metal chelate or its accompanying solvation sphere.

Microfilm \$2.75; Xerox \$6.20. 127 pages.

AN EVALUATION OF CHRONOPOTENTIOMETRY
AND AN INVESTIGATION OF SEVERAL
NEW TYPES OF CONSTANT CURRENT
LINEAR DIFFUSION PROBLEMS

(Order No. Mic 61-2154)

Thomas Owen Rouse, Ph.D.
University of Minnesota, 1961

Adviser: Dr. Stanley Bruckenstein

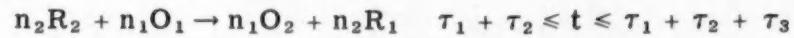
Chronopotentiometry is the study of the potential-time relations obtained with semi-infinite linear diffusion to an electrode during constant current electrolysis. The purpose of this investigation was to consider some new aspects of chronopotentiometry.

The evaluation of the effective electrode area is important in determining the current density in the electrolysis process. This evaluation is not difficult for a properly designed solid electrode, but is more difficult in the case of a mercury pool electrode because of the curvature of the electrode surface due to surface tension effects. The area of the mercury electrode used in this investigation was determined for several systems by intercomparison of the chronopotentiometric results of each system at the mercury pool electrode and at either a platinum or mercury coated platinum electrode. In 0.1 M aqueous potassium nitrate the effective area of a mercury pool (5/8" teflon cup) is 17% larger than the projected area.

A simple, but rigorous method of solution for the diffusion boundary value problems arising in chronopotentiometry is presented. This method, which, although well known, has not been previously reported in the electrochemical literature in this connection, is based on the application of Green's Function for continuous planar diffusion sources.

The relations for three new chronopotentiometric problems have been determined. These include the case of an electrode reaction followed by current reversal in solution which originally contains both oxidized and reduced species. The relations for this case were verified for thallium at a thallium amalgam electrode in glacial acetic acid.

The second new problem is based on the reaction chain;



O_1 and O_2 are originally present in the bulk of the solution. The electrolysis current causes the reduction of O_1 and O_2 until time, $\tau_1 + \tau_2$. The current is then stopped and the chemical reoxidation of R_2 takes place. This reoxidation is assumed to be fast compared to diffusion. The resulting relation for this case is

$$\tau_2 = 2 \sqrt{\tau_1 \tau_3}$$

This relation has been verified for mixtures of lead and cadmium in 0.1 M potassium nitrate. The problem has also been solved where R_1 and O_2 are identical and are initially absent from the solution. The solution in this case is identical with the one given above and has been verified for Cu(II) in 0.5 M ammonium oxalate.

The third problem is identical with that above until time $\tau_1 + \tau_2$. The direction of the electrolysis current is reversed at time $\tau_1 + \tau_2$. The reoxidation of R_2 results from the reaction



and



The solution for this

$$\tau_2 = 3 \tau_3 + 4(\tau_1 \tau_3)^{1/2}$$

has been verified for mixtures of lead and cadmium.

A comparison of the utility of chronopotentiometry and polarography in glacial acetic acid has been made with respect to the diffusion coefficients, reversibility and reduction potentials of the reactions, and the complications due to IR drop. Thallium and cadmium ions have been studied in this solvent.

The cathodic limit of the potential range available for study chronopotentiometrically has been compared with that found for polarography. The limitations on the use of chronopotentiometry because of this potential limit and because of the charging of the electrode double layer have been considered.

A value of 20 ± 3 has been found for the constant in the modified Ilkovic (Lingane-Loveridge) equation using the values for the diffusion coefficients found throughout this investigation.

Microfilm \$3.00; Xerox \$10.60. 232 pages.

INFRARED SPECTRA OF SUBSTITUTED 1,10-PHENANTHROLINES.

(Order No. Mic 61-2273)

Robert Carl Smith, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Harvey Diehl

The infrared spectra of 1,10-phenanthroline and of one hundred and thirty-six 1,10-phenanthroline derivatives have been obtained and studied in detail.

The purity of the available 1,10-phenanthrolines has been carefully checked and impure materials recrystallized and analyzed. Sixteen 1,10-phenanthroline derivatives, not otherwise available, have been synthesized and purified following procedures previously described.

The spectrum of 1,10-phenanthroline has four regions of strong absorption. Assignments of the absorption bands in these regions to specific modes of vibration in the molecules which have been previously reported have been critically examined, and certain new assignments have been proposed.

A large shift to lower frequency of the C-H stretching absorption has been found in the spectra of the 1,10-phenanthrolines in chloroform solution; this has been attributed to the interaction of the solvent with the 1,10-phenanthroline ring nitrogen atoms.

The acid salts of 1,10-phenanthroline have also been studied, and the alterations in the spectra from that of the parent, free base have been attributed to shifts of the ring vibration bands to higher frequencies. In some instances the "immonium bands" found in the $2066-1912 \text{ cm}^{-1}$ range as very weak and broad absorptions have been used as aids in identification of these salts.

The absorption bands which appear or are altered by the introduction in the 1,10-phenanthroline molecule of various substituents, as methyl, ethyl, propyl, halogen, phenyl, methoxy, phenoxy, dione, hydroxy, nitro, amino, aza, dioxime, dialkylaminoalkyoamino, R-R', cycloalkeno, benzo, and pyrido, have identified. The general characteristics of spectra of the 1,10-phenanthroline derivatives have been established.

Examination of the infrared spectra of these numerous 1,10-phenanthroline derivatives has shown that in certain regions, patterns exist which are characteristic of the number and position of the substituents in the molecule but are essentially independent of the nature of the substituent. Three regions have been found to be useful in this respect. The 5.0-6.0 micron ($2000-1667 \text{ cm}^{-1}$) region has provided the most useful and versatile information for characterization of position of substituents on 1,10-phenanthroline. Confirmatory information on the substitution type present has been found in the $1667-1250 \text{ cm}^{-1}$ and $900-650 \text{ cm}^{-1}$ regions.

Microfilm \$3.75; Xerox \$13.30. 291 pages.

EFFICIENCY OF CHEMICAL DESICCANTS

(Order No. Mic 61-2276)

Fred Charles Trusell, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Harvey Diehl

The efficiency of several chemical desiccants has been studied by passing humidified nitrogen over the desiccants at a flow rate of 225 ml per minute and freezing out the residual water in a tube immersed in liquid nitrogen. By measuring the total volume of gas used and by weighing the water in the cold trap, the residual moisture in the gas stream in terms of micrograms of water per liter of gas has been calculated.

It has been shown that as a desiccant, anhydrous magnesium perchlorate stands in a class by itself, being nearly 10 times as efficient as the next best drying agent tested, Anhydrone [$Mg(ClO_4)_2 \cdot 1.5 H_2O$]. Following Anhydrone in efficiency are barium oxide, alumina, phosphorus pentoxide, Molecular Sieve 5A (a synthetic zeolite), and magnesium

perchlorate, anhydrous, indicating. All of these leave less than five micrograms of water per liter of gas.

The common practice of following Ascarite (sodium hydroxide on asbestos) and Mikohbite (sodium hydroxide on fluffed mica) with a desiccant when these materials are used as absorbants for carbon dioxide has been justified. The futility of using calcium chloride for this purpose has been indicated.

The gravimetric method employed was shown to be quantitative, as oxygen condensed in the freeze-out tube when air was employed as the carrier gas. This indicates that the carrier gas was cooled to at least -183° , at which temperature the equilibrium vapor pressure of water over ice is 2.3×10^{-19} mm Hg. Such a vapor pressure would permit the loss of only negligible amounts of water.

In accord with the findings of Morley,¹ it was determined that a negligible weight of phosphorus pentoxide was vaporized when that substance was utilized as a desiccant. However, contrary to his findings, a distinctly measurable amount of water remained in the nitrogen stream dried over this reagent.

It should be noted that the low efficiency of calcium oxide and magnesium oxide, and the apparent low capacity of the latter, make them unsuitable as drying agents under the conditions tested.

Unsuccessful attempts were made to determine the efficiency of the desiccants by detecting the residual water in helium dried over them with an ionization gauge. Several circuits were tried, but none was satisfactory.

The Consolidated Electrodynamics Corporation Moisture Monitor Type 26-302, was employed to measure the water vapor remaining in nitrogen dried over the various desiccants. The results from this instrument are discordant with those of the gravimetric method. It should be noted, however, that the flow rates of the carrier gas was not the same for both methods.

1. Morley, E. W., J. Am. Chem. Soc., 26:1171. 1904.
Microfilm \$2.75; Xerox \$3.00. 58 pages.

VARIABLES IN FLAME SPECTROPHOTOMETRY, THEIR CONTROL AND ELIMINATION.

(Order No. Mic 61-1092)

Allen Crawford West, Ph.D.
Cornell University, 1961

The large number of variables that affect flame spectrophotometry make reproducible results difficult to obtain and limit valid comparisons among the results of different workers using various instruments and techniques.

The nature of these variables has been discussed and they have been divided into two broad classes; instrumental variables, which can be controlled for a given instrument, and solution variables, which are not easily controlled and have been called interferences. A recording flame spectrophotometer was built incorporating the Beckman DU spectrophotometer with flame attachment and has been described. The control and elimination of instrumental variables has been discussed with respect to this instrument.

Two types of interferences have been studied; those

caused by reactions and equilibria in the solution or gas phase, and those caused by changes in the physical properties of the solution. Into the first category fall interferences due to anions and cations and the mechanism of their interaction with the sample element, calcium has been discussed. It has been ascribed to compound or complex formation in the solution phase or evaporating liquid droplet in the flame, followed by a decomposition in the solid or gas phase whose rate is the controlling step.

Interferences caused by changes in the physical properties of the solution have been investigated using anions of organic acids, acetone and a surface active agent, Triton X-100. Properties such as surface tension, viscosity, vapor pressure and density have been discussed, and the mechanism of interferences of this type explained in terms of these properties for each system. In addition, interferences caused by reactions and equilibria in the solution have been also attributed to organic anions.

Ethylenediaminetetraacetate has been used for the purpose of eliminating solution variables. This technique has been described and has been found suitable in the case of anion interferences. This reagent has also been used for other elements than calcium for the suppression of anion interferences.

Microfilm \$2.75; Xerox \$3.80. 69 pages.

CHEMISTRY, BIOLOGICAL

BERYLLIUM BINDING OF BOVINE SERUM ALBUMIN AND EPIDERMAL CONSTITUENTS

(Order No. Mic 61-2621)

Sidney Belman, Ph.D.
New York University, 1958

Adviser: Norton Nelson

Beryllium toxicity in man and animals is believed to involve some interaction with tissue protein and little is known of such interactions. With the aim of improving our understanding of beryllium toxicity the immunochemical study of beryllium and its reactions with epidermis and a purified protein, bovine serum albumin (BSA), were undertaken.

The delayed allergic reaction to beryllium was demonstrated in guinea pigs. The epidermis was found to contain a thromboplastin which prevented the testing of a beryllium-specific anaphylaxis. The in vitro reactions of beryllium with epidermis at pH 7.5 were mostly studied with the method of equilibrium dialysis. The difficulty of working with colloidal beryllium was overcome by the development of procedures which involved the use of tracer Be⁷ and plastic vials. The soluble fraction of epidermal homogenates had a greater specific binding activity than the insoluble residue and was found to contain alkaline phosphatase. This enzyme is known to bind and to be inhibited by beryllium and is present in the granular layer of the epidermis where beryllium is also localized. The enzyme was purified 23 fold and some of its properties

examined. The K_I for beryllium was 5×10^{-6} . The beryllium binding of the purified enzyme at pH 7.5 revealed that it had a high specific binding activity. Comparisons with the epidermis indicated that 46% of the total epidermal binding could be attributed to this enzyme. Attempts to separate the enzyme from other beryllium binding constituents resulted in an increased binding of some of the epidermal fractions. This was suspected of being due to denaturation. In confirmation of this it was found that at pH 7.5 heat denatured BSA and conalbumin bound more beryllium than the native proteins.

The difficulty of working with colloidal beryllium was not present at lower pH's and studies were made at pH 5 and lower. Equilibrium dialysis studies revealed that native and heat denatured BSA reversibly bound beryllium and that the latter had a greater binding activity. The reversible binding of native BSA was examined at $\mu = 0.15$, several pH's, and at three temperatures. Binding occurred above pH 3.5. The average intrinsic association constant, k , was 36.2 at pH 4.5 and 5.0, and was independent of temperature. The number of binding sites, n , showed an apparent increase with pH and temperature. At pH 4.5, $T = 4^\circ, 25^\circ$, and 37°C , n was 20, 23, and 25, respectively. At pH 5.0, at the same temperatures, n was 29, 36, and 43 respectively. The results at pH 4.0, $T = 25^\circ$ and 37° were $k = 20$, and $n = 37$ and 27 respectively. Esterified BSA at pH 5.0, $T = 4^\circ$ and 37°C , did not bind beryllium.

The increased binding with increasing pH and temperature was attributed to the increase in availability of reactive sites, which were indicated by the data to be the ionized carboxyls. Detergent (Duponol) denatured BSA was more flexible than the native protein in that at constant pH and temperature the binding increased with the bound beryllium in such a way as to indicate a cooperative effect. The thermodynamics of the reaction with native BSA gave $\Delta H^\circ = 0$, $\Delta F^\circ = -2000 \text{ cal/mol}$, $\Delta S^\circ = 7.3 \text{ cal/deg/mol}$.

The reactions of beryllium with BSA are compatible with the behaviour of this protein with respect to its lack of carboxyl reactivity and with the change of its reactivity under the influence of environmental conditions.

Microfilm \$2.75; Xerox \$5.00. 98 pages.

ADRENOCORTICAL STEROID PROFILE IN THE HYPERTENSIVE DOG

(Order No. Mic 61-2820)

Paige Keith Besch, Ph.D.
The Ohio State University, 1961

The adrenals are essential to the development of experimental renal hypertension. This raises the question of their role in the pathogenesis and maintenance of high blood pressure. Therefore, an investigation of adrenal steroid production in hypertensive animals seemed important.

Hypertensive dogs were prepared by various types of renal constriction. The plasma (2.6L) obtained by adrenal venous cannulation in these hypertensive animals was compared with similarly obtained adrenal plasma (3.5L) from normal dogs.

Standard techniques of extraction, chromatography, and classical chemical methods were used to isolate the

steroids. These steroids were identified by their mobilities in various chromatographic systems, UV absorption spectra, and oxidative derivative formation. Once a tentative identification of a steroid was obtained, it was compared with an authentic sample and again tested by the above techniques. All authentic reference standards were synthesized or obtained elsewhere.

The results may be summarized as follows:

Though the adrenal weights in the hypertensive and normal groups showed no significant difference, histologically, the zona glomerulosa was markedly increased.

Mean plasma flow when calculated on the basis of ml/hr/Kg body weight was larger ($.20 < p < .05$) for the controls. However when calculated on the basis of ml/hr/gm adrenal/Kg body weight, the values were not significantly different for the two groups ($.30 < p < .50$). No correlation was observed between adrenal blood flow and degree of blood pressure elevation or between severity of hypertension and heart weight.

The mean values for the adrenal plasma aldosterone levels were significantly larger in the hypertensive animals, 0.1503 micrograms/Kg/Hr, than in the normotensives, 0.0658 microgram/Kg/Hr ($.05 < p < .10$). Also the mean values for adrenal plasma cortisol levels were significantly higher in the hypertensive group, i.e., 16.51 micrograms/Kg/Hr, as compared with 8.28 micrograms/Kg/Hr ($p < .01$).

The more polar than cortisol area, BF, in the hypertensive group contained eight compounds. Four of these were identified as (1) 20 beta-hydroxytetrahydrocortisone ($3.67 \times 10^{-9} \text{ M/Kg/Hr}$); (2) tetrahydrocortisol ($3.105 \times 10^{-9} \text{ M/Kg/Hr}$); (3) tetrahydrocortisone ($3.395 \times 10^{-9} \text{ M/Kg/Hr}$); (4) 20 beta-hydroxy-cortisol ($6.60 \times 10^{-9} \text{ M/Kg/Hr}$). Two were tentatively identified as (1) 6 beta-hydroxy-cortisol ($2.930 \times 10^{-9} \text{ M/Kg/Hr}$) and (2) allo-tetrahydrocortisol ($0.943 \times 10^{-9} \text{ M/Kg/Hr}$). Two very polar steroids were present in quantities far too small for identification. In the plasma from the normotensive dogs, on the other hand, only two compounds were found in the BF area: (1) tetrahydrocortisone ($3.820 \times 10^{-9} \text{ M/Kg/Hr}$) and (2) tetrahydrocortisol ($5.298 \times 10^{-9} \text{ M/Kg/Hr}$).

Thus a significant difference in the steroid profile of adrenal venous plasma from hypertensive and normotensive dogs has been shown, particularly as related to the very polar compounds. The possible physiological importance of these findings is discussed in the light of the relevant literature.

Microfilm \$2.75; Xerox \$9.25. 204 pages.

SPECIFIC PHASES IN THE METABOLISM OF CARDIAC MUSCLE UNDER NORMAL AND EXPERIMENTAL CONDITIONS

(Order No. Mic 61-2622)

Ellen Borenfreund, Ph.D.
New York University, 1958

Adviser: Dr. M. J. Kopac

A study of heart muscle under various physiological and pathological conditions might help in elucidating the significance of chemical processes in the interrelationship of cardiac metabolism and cardiac function.

Two specific problems were selected for this study:

1. The direct oxidative glycolytic pentose phosphate pathway was investigated. The breakdown of ribose-5-phosphate and formation of intermediates was determined. Normal heart tissues were studied as well as those of rats under hormonal stress by determining the effects of insulin, epinephrine, and Hydrocortone acetate on the pentose phosphate pathway under both *in vivo* and *in vitro* conditions.

2. Experiments were designed to investigate whether acute stress, due to physiological or pathological changes, could impair aerobic phosphorylation and result in variations in the nucleotide fractions. Tachycardia was experimentally induced in open-chest dogs to produce physiological changes. For the study of pathological effects, rabbits were injected with Streptolysin "O".

The investigation of the pentose phosphate cycle was carried out with the help of a number of colorimetric microdeterminations, paper chromatography, and enzymatic tests. Cardiac muscle was incubated with ribose-5-phosphate at 33°C in the presence of sodium fluoride and bromoacetate. The conversion of the substrate was determined by terminating the reaction at different time intervals. The isomerization of ribose-5-phosphate to ketopentose-5-phosphate was found to be at equilibrium after 45 minutes of incubation. At this time about 55 per cent of the original amount of aldopentose had been converted to the equilibrium mixture. After three hours of incubation the intermediates, sedoheptulose phosphate, fructose-1,6-diphosphate and triose phosphate as well as fructose-6-phosphate and glucose-6-phosphate, were identified and balance experiments were carried out. Incubation of heart muscle with glucose-6-phosphate as a substrate resulted in an isomeric mixture in which fructose-6-phosphate represented 25 per cent of the total hexose added. The amounts of sedoheptulose, which could be detected, were minimal even after prolonged incubation. This indicates that the equilibrium of the pentose phosphate cycle favors the formation of glucose-6-phosphate.

These studies demonstrated that a complete enzymatic system capable of converting ribose-5-phosphate to glucose-6-phosphate is present in the heart muscle. This pathway seems to be unaffected by the several hormones tested under both *in vivo* and *in vitro* conditions.

A special freezing technique was worked out for the investigation of energy metabolism of heart muscle obtained from dogs. This method permitted removal of heart tissue from the same animal both before and after induction of tachycardia. Muscle extracts obtained from these tissues were analyzed for adenosine nucleotides, nucleic acid, glycogen, and labile phosphates. No significant differences between the control and experimental samples could be observed.

Streptolysin "O", injected into rabbits in small dosages, resulted in almost immediate contracture of the heart. Nucleotide, glycogen, and phosphate fractions as well as adenosine triphosphatase activity of the heart muscle appeared to be unaffected by this treatment.

Microfilm \$2.75; Xerox \$5.20. 105 pages.

EXTRACTION, PARTIAL PURIFICATION, AND CHEMICAL CHARACTERIZATION OF SHEEP FOLLICLE STIMULATING HORMONE.

(Order No. 61-2903)

Charles Leslie Cahill, Ph.D.
The University of Oklahoma, 1961

Major Professor: M. R. Shetlar, Ph.D.

It has been apparent for two decades that the anterior lobe of the pituitary gland contains certain substances which stimulate the gonads. Controversy has arisen concerning pituitary gonadotropic hormones as to their chemical and physiological characteristics. The complex interrelationships of these hormones to one another has made differentiation of the two extremely difficult. Evidence accumulated to date appears to favor the concept that there are two distinct gonadotropic hormones, i.e., follicle stimulating and luteinizing hormones. Both of these pituitary gonadotropins have been characterized as glycoproteins.

The purpose of this investigation has been to prepare from sheep pituitary tissue a relatively pure follicle stimulating hormone free of luteinizing hormone and to study its chemical and physiological characteristics.

The pituitary tissue was extracted initially with a 1.0 M urea solution. The initial extract was fractionated by variation of pH and ammonium sulfate concentration. The preparation obtained by salt fractionation was further purified by electrophoretic separation on a starch column. Each step in the fractionation procedure was followed by an assay of biological activity performed in diethylstilbestrol-treated hypophysectomized immature rats. The preparation obtained by electrophoresis on a starch column was shown to contain follicle stimulating activity with no luteinizing hormone activity.

The follicle stimulating preparation was analyzed for its elemental content. The carbohydrate constituents were studied analytically and identified in paper chromatographic studies.

The effect of proteolytic enzymes on the biological activity of the follicle stimulating preparation was investigated. Pepsin and trypsin were the enzymes used in these studies and both were shown to completely destroy the follicle stimulating activity.

The effect of various amylolytic enzyme preparations on the biological activity of the follicle stimulating preparation was also studied. The enzyme preparations used in these studies were α -amylase, β -glucuronidase, influenza virus, and a *pneumococcus* preparation; each was shown to cause a definite degree of inactivation. Chemical analysis of the follicle stimulating preparation after incubation with each amylolytic enzyme preparation indicated that inactivation was accompanied by a decrease in certain of the protein bound carbohydrate components.

Microfilm \$2.75; Xerox \$3.00. 52 pages.

**THE SYNTHESIS AND METABOLISM
OF S³⁵-(1,2-DICHLOROVINYL)-L-CYSTEINE.**

(Order No. Mic 61-2138)

Robert Frederick Derr, Ph.D.
University of Minnesota, 1961

The metabolism of S-(1,2-dichlorovinyl)-L-cysteine (DCVC), a compound which can induce fatal aplastic anemia in susceptible species (bovine, equine), was investigated in the rat and the calf. For this purpose S³⁵-DCVC was synthesized by the following sequence of reactions:

1. S³⁵-potassium hydrogen sulfide was prepared by passing S³⁵-hydrogen sulfide, generated from S³⁵-barium sulfide with acid, into alcoholic potassium hydroxide.
2. Benzyl chloride was condensed with the S³⁵-potassium hydrogen sulfide to form S³⁵-benzyl mercaptan.
3. The S³⁵-benzyl mercaptan was then condensed with 2-amino-3-chloro-L-propionic acid hydrochloride in the presence of sodium ethoxide to form S³⁵-benzyl-L-cysteine.
4. The S³⁵-benzyl-L-cysteine was reduced by sodium in liquid ammonia to S³⁵-disodium-L-cysteinate which was treated in the same solvent with trichloroethylene to form S³⁵-DCVC with a specific activity of 18.1 x 10⁶ cpm/mg.

The S³⁵-DCVC was administered to rats and to a calf. The urine of these animals was examined with respect to the amounts and kinds of radioactive compounds excreted and total radioactivity was measured in urine, feces, exhaled gases, and in various tissues.

The radioactivity rapidly disappeared from the blood of rats. Of the radioactivity remaining in the blood of the rats at the termination of the experiment, 2/3 was found in the plasma, some of which was in non-dialyzable form. Rat oxyhemoglobin was radioactive. As much as 53% of the radioactivity administered to rats was excreted in the urine in 3 days; 5% was eliminated in the feces in 3 days. Negligible amounts of radioactivity were found in the expired gases of the rats. The kidneys, heart, and liver of rats contained the highest radioactivity per gram of tissue. Approximately 34% of the radioactivity excreted in rat urine in the first 24 hours after administration of S³⁵-DCVC was inorganic sulfate, 18.5% was DCVC, and 41.5% was N-acetyl-DCVC. A fourth, and unidentified radioactive component contained 6% of the radioactivity. Homogenates of rat liver and kidney are able to metabolize DCVC.

DL-phenylalanine at a molar ratio of 51:1 is able to partially overcome the toxicity of DCVC (20 mg./kg./day) to rats.

When S³⁵-DCVC was administered intravenously to a calf, the rate of urinary excretion of radioactivity was initially very rapid, decreasing exponentially, within the first 15 hours to less than 10% of the initial rate. Of the total radioactivity administered, 50.4% appeared in the urine in 72 hours; 17.8% was excreted in the feces during 69 hours. The radioactivity in the blood plasma and in the lymph of the calf was about the same per ml.; in the interval between 2 and 4 hours after injection of S³⁵-DCVC it had decreased to about 50% of that found after 10 minutes. About 10% of the radioactivity of the blood plasma was in

non-dialyzable form. Of this amount 2/3 was associated with the albumin fraction and 1/3 with the alpha globulin fraction which were separated by paper electrophoresis. Oxyhemoglobin crystallized from calf blood was radioactive; the radioactivity was non-dialyzable and 78% of it could not be removed by treatment with sodium bisulfite or 2-mercaptoethanol. The kidney, liver, costochondral cartilage, and the vitreous humor of the eye of the calf had the highest radioactivity per gram of tissue; the kidneys contained about 6½ times the radioactivity found in the other tissues mentioned. The radioactive components of the urine were separated into at least 8 fractions by ion-exchange chromatography, 22% of which was identified as inorganic sulfate. None of the other radioactive components were identified. No N-acetyl-DCVC and not more than 1.3%, if any, of the administered DCVC was excreted as DCVC by the calf in the urine produced within 100 minutes. Homogenates of calf liver and kidney are able to metabolize DCVC, while DCVC is relatively stable in lymph node homogenates.

Microfilm \$2.75; Xerox \$6.80. 144 pages.

**STRUCTURAL MODIFICATIONS OF NEOMYCIN-
AND STREPTOMYCIN-TYPE ANTIBIOTICS**

(Order No. Mic 61-2180)

Constantino John Di Cuollo, Ph.D.
Rutgers University, 1961

Major Professor: Dr. Carl P. Schaffner

Streptomycin derivatives have been prepared in the past with the intention of eliminating undesirable side effects, such as eighth cranial nerve damage and the formation of resistant infections in the treatment of tuberculosis. The purpose of this study was two-fold. Firstly, a study was undertaken to prepare new, biologically active derivatives of dihydrostreptomycin. Secondly, an attempt was made to locate the active site of activity for the basic water-soluble antibiotics. In this respect, guanidinated derivatives of neamine, kanamycin, and neomycin antibiotics were prepared for biological studies.

The 1-hour barium hydroxide hydrolysis of dihydrostreptomycin gave rise to several new biologically active intermediates not reported previously in the literature. These substances were isolated and purified by a combination of techniques, including ion exchange, paper chromatography, cellulose column chromatography, and re-precipitation techniques. These intermediates were partially characterized chemically and found to be mono-amino, mono-guanido, dihydrostreptomycin compounds, and were shown to have an activity one-fifteenth to one-thirtieth that of dihydrostreptomycin. Other similar derivatives were isolated and shown to have still lower activity. These intermediates were postulated to arise thru the hydrolysis of different tautomeric forms of the guanido groups present on the dihydrostreptomycin molecule.

To study the relationship existing between basicity and biological activity of the basic, water-soluble antibiotics, highly basic, guanidine derivatives were prepared of the neomycin-type antibiotics and studied for their biological properties.

The reaction of the neomycin-type antibiotics with S-methylisothiourea in the formation of partially and completely guanidinated derivatives of neomycin, kanamycin, and neamine was studied. These derivatives were found to be of considerably lowered activity when compared to the parent compounds.

Conclusions drawn from these studies indicate that although the basic groups on the dihydrostreptomycin molecule were essential for maintaining high activity, a generalization could not be made regarding the neomycin-type antibiotics. Increasing basicity in this case did not increase biological activity. It was concluded from these studies that biological activity in these antibiotics was dependent not only on basicity but also the proper configurational relationships between the antibiotics and the enzyme systems in the microorganism.

Microfilm \$2.75; Xerox \$8.40. 181 pages.

HORMONAL REGULATION OF GROWTH IN A LIZARD, ANOLIS CAROLINENSIS.

(Order No. Mic 61-2119)

Anthony DiMaggio III, Ph.D.
Louisiana State University, 1961

Supervisor: Professor Herbert C. Dessaer

Anolis appears to be "functionally hypophysectomized" when exposed to short photoperiods. Experiments were designed to determine whether daily injections of hormones could stimulate growth in anoles "functionally hypophysectomized" by exposure to six hours of light per day. Injections of either 10 mg./kg./day of bovine growth hormone or 7 mg./kg./day of desiccated thyroid stimulated growth due to increased tissue protein. Optimal growth occurred in animals injected with a combination of 10 mg./kg./day of growth hormone, 7 mg./kg./day of desiccated thyroid, and 25 mg./kg./day of insulin. Insulin alone did not stimulate growth. Unlike exposure to long photoperiods which stimulate growth with increased calorie consumption, hormone injections stimulated growth without augmentation of appetite. Growth of hormone injected animals appeared to result from more efficient utilization of food.

On the basis of nitrogen excretion rates during fasting at 28°C., catabolism of tissue proteins supplied 62% of standard metabolic requirements in spring and early summer but supplied only 20% in winter. Daily injections of growth hormone did not affect fasting nitrogen excretion. Glucose feeding "spared" 0.6 mg. tissue protein/mg. glucose fed.

The rate of catabolism of dietary protein also appeared to vary seasonally. Anoles were fed single high protein meals adequate in calories for six days. In spring the nitrogen excreted in three days after feeding was equivalent to protein fed. In autumn nitrogen excreted was equivalent to only 60% of protein fed. Nitrogen excretion of fed anoles injected daily with growth hormone was 25% greater than that of non-injected anoles. Nitrogen metabolism is active in spring and summer when dietary protein is utilized as an energy source and in growth processes. Nitrogen metabolism is decreased in winter when food con-

sumption and growth processes are minimal, and maintenance calories are obtained from catabolism of stored fats and carbohydrates.

Growth processes cannot be fully understood without knowledge of the control of carbohydrate metabolism. In an attempt to obtain further evidence on basic factors responsible for observed seasonal differences in gross tissue composition, the manner in which anoles disposed of 40 mg. of glucose was determined at various seasons. In autumn tissue glycogen was stable and at a maximum concentration. Forty-eight hours after injection glucose appeared chiefly in liver glycogen. In winter carbohydrate was mobilized to extra-hepatic tissues where glucose utilization proceeded rapidly. In spring and summer when tissue glycogen was labile, injected glucose was probably rapidly oxidized.

Anolis was sensitive to bovine glucagon and insensitive to bovine insulin. Injection of 1 mg./kg. of glucagon abolished the hypoglycemic effect of 25 mg./kg. of insulin. Glucagon and insulin appear to act synergistically in the transportation of glucose from liver to muscle as occurs in winter. The hyperglycemic response to glucagon correlated with initial liver glycogen. Growth hormone caused a hyperglycemia but, contrary to findings in other species, led to an 18% decrease in extra-hepatic glycogen. Tissue carbohydrate in "functionally hypophysectomized" anoles injected with a combination of growth hormone, desiccated thyroid, and insulin was low as in anoles during spring and summer.

Seasonal differences in the physiological state of Anolis appear to be controlled by cyclic changes in activities of its endocrine organs. Growth occurs only when endocrine secretions are in favorable balance.

Microfilm \$2.75; Xerox \$4.20. 76 pages.

STUDIES OF FLAVONOID COMPOUNDS FROM THE SWEET ORANGE AND THE GRAPEFRUIT

(Order No. 61-2935)

William Joe Dunlap, Ph.D.
The University of Oklahoma, 1961

Major Professor: Simon H. Wender

The flavonoid compounds found in citrus fruits have received considerable attention, principally because of their possible physiological activity. However, little was known of the individual flavonoid content of the various fruits, in that previous investigations have usually succeeded only in identifying the one or two flavonoids present in greatest quantity in a particular fruit. This situation was attributed to the extreme difficulty of separating closely related flavonoid glycosides.

Flavonoid preparations from the sweet orange, Citrus sinensis, were subjected to studies by chromatographic techniques for the purpose of finding a method of separating closely related flavonoid glycosides. Column chromatography, employing Magnesol as adsorbant and water-saturated ethyl acetate as eluting solvent, proved to be a good method for separation of some closely related flavanone glycosides; even glycosides present only in

trace quantities were isolated by means of this procedure. By repeated passage through appropriate sizes of Magnesol columns, the isolated fractions were purified, and eventually chromatographically pure compounds were obtained.

Identification of pure flavanone glycosides obtained by column chromatography was achieved by a combination of semi-micro and paper chromatographic techniques. A method for positive identification of very small quantities of flavanone aglycones obtained by hydrolysis of purified glycosides was developed by adapting to semi-micro scale the aqueous potassium hydroxide degradation of flavanones, and identifying the degradation products by paper chromatography. Employing these methods, two flavanone glycosides never before found in the sweet orange, the 7-rhamnoglucoside of isosakuranetin (5,7-dihydroxy-4'-methoxyflavanone) and naringin (7-rhamnoglucoside of naringenin, 4',5,7-trihydroxyflavanone) were identified. Hesperidin (7-rhamnoglucoside of hesperetin, 3',5,7-trihydroxy-4'-methoxyflavanone), the principal flavanone glycoside of the sweet orange, was prepared in chromatographically pure form.

The chromatographic procedures developed in studies on the sweet orange flavonoids were applied to investigation of a flavonoid preparation from the grapefruit, *Citrus paradisi*. Isosakuranetin-7-rhamnoglucoside and another flavanone glycoside which appeared to be a rhamnoglucoside of naringenin, but differed from the principal glycoside of the grapefruit, naringin (naringenin-7-rhamnoglucoside), were isolated. A flavone glycoside, rhoifolin (7-rhamnoglucoside of apigenin, 4',5,7-trihydroxyflavone) was also identified in the grapefruit flavonoid preparation.

The isosakuranetin-7-rhamnoglucosides isolated from the sweet orange and grapefruit differed slightly, the difference between the two compounds possibly being in position of the linkage of rhamnose to glucose in the sugar moiety of the molecule.

The flavonoid aglycones obtained by hydrolysis of the grapefruit flavonoid preparations were fractionated by chromatography, first on Magnesol and then on silicic acid columns. Apigenin and the flavonol aglycone kaempferol (4',5,7-trihydroxyflavonol) were isolated and identified in this manner. Microfilm \$2.75; Xerox \$4.00. 72 pages.

THE BIOLOGICAL OXIDATION OF NICOTINE.

- I. NICOTINE DEGRADATION
BY *NICOTIANA RUSTICA*.
- II. NICOTINE DEGRADATION BY
AN *ARTHROBACTER* SPECIES.

(Order No. Mic 61-2694)

Gail Denise Griffith, Ph.D.
Michigan State University, 1961

Major Professor: R. U. Byerrum

Metabolism of nicotine in the tobacco plant has remained largely unexplored, although it has been demonstrated that the alkaloid is not an inert plant constituent but can be converted to other materials. In the present study nicotine-C¹⁴ was supplied to tobacco plants and nicotine, nicotinic acid, and cotinine were isolated after periods of metabolism of 4, 7, or 14 days. Approximately

60 to 80% of the total radioactivity fed to the plants was recovered as nicotine dipicrate in all experiments.

Nicotinic acid, isolated as the hydrochloride, contained a significant amount of isotope. Calculated dilutions of specific activity in going from nicotine to nicotinic acid were low enough to support the hypothesis that nicotinic acid was formed from nicotine in the plants by oxidation of the pyrrolidine ring of nicotine. The essential metabolic role of nicotinic acid in living organisms has been well established; its production from nicotine in the tobacco plant suggests that the alkaloid may serve as a reserve source of this compound.

Cotinine, isolated from the plants as the perchlorate, was also radioactive but evidence indicated that the incorporation of C¹⁴ into the molecule was the result of a non-metabolic process.

Microorganisms were observed in nutrient medium in which tobacco plants had been grown which had the ability to catalyze the oxidation of nicotine to a product having an ultraviolet absorption spectrum markedly different from that of the parent compound. A microorganism was isolated from this source that proved to be a species of *Arthrobacter* resembling *Arthrobacter oxydans* in cultural and morphological characteristics. The bacteria catalyzed the production of 6-hydroxynicotine in approximately 50% yield from nicotine in a medium containing nicotine, inorganic salts and a small amount of yeast extract. The identity of the product was established by its melting point, the melting point of the picrate derivative, ultraviolet and infrared absorption spectra, molecular extinction values, elementary analysis, and specific rotation.

The significance and implications of these findings are discussed. Microfilm \$2.75; Xerox \$3.00. 35 pages.

STUDIES ON THE DISTRIBUTION OF XANTHINE OXIDASE BETWEEN THE FAT AND SKIM MILK PHASES OF MILK AND THE EFFECT OF AGING ON HEAT STABILITY OF THE ENZYME

(Order No. Mic 61-2449)

Geir Valberg Gudnason, Ph.D.
Cornell University, 1961

One purpose of this study was to investigate variations in xanthine oxidase activity in milk, and especially the apparent increase in activity after certain physico-chemical treatments. Another purpose of this study was to investigate the effect of aging on the heat stability of xanthine oxidase in milk.

Enzyme activity was determined by the Warburg manometric technique, and expressed as $\mu\text{l O}_2/\text{ml/hr}$.

The activity of xanthine oxidase in milk increased as a result of storing at 4°C., heating to 70°C. for 5 minutes, homogenization, and incubation with commercial enzymes of proteolytic and lipolytic nature.

On storing of fresh, raw milk for 24 hours at 4°C., an approximately two-fold increase in the activity of xanthine oxidase was observed, after which no further increase occurred. This increase was accompanied by a large increase of activity in the skim milk phase, with a

corresponding decrease of activity in the fat phase. Heating to 70° C. for 5 minutes, and homogenization, also increased the activity found in the skim milk phase.

On storing fresh, raw milk, cream, and skim milk, for 24 hours at 4° C., it was found that the enzyme activity increased in both milk and cream, but no increase took place in the skim milk.

By separating several raw samples stored for 24 to 48 hours at 4° C. and then separating portions of the same samples after 3 additional days of storage, it was shown that in all instances about 70% of the enzymatic activity was found in the skim milk. It was also demonstrated that no redistribution of the enzyme occurred after 48 hours.

The theory was advanced that in uncooled milk the enzyme microsomes are found in large aggregates adsorbed on the fat globule membrane, perhaps limiting substrate or hydrogen acceptor penetration to the site of the reaction. Only by breaking up the microsome aggregates, by physical or other means, thus releasing the microsomes into the skim milk phase, may the full activity of the enzyme in milk be determined.

The age of milk samples is a critical factor in determining heat inactivation of xanthine oxidase at various temperatures. It was found that the heat sensitivity at all the temperatures used (between 60 and 80° C.), increased greatly on aging at 4° C.

The difference in heat sensitivity on aging was more noticeable at 70° C. than at other temperatures studied, over the range from 60-80° C. Fresh or nearly fresh samples were inactivated only to a slight degree by heating to 70° C. for 5 minutes. Five day old samples, on the other hand, were 50-60% inactivated by the same treatment. Furthermore, the heat sensitivity increased gradually over the five day period. These changes followed a similar pattern also in cream and skim milk.

Homogenization accelerated the aging effect, and incubation of samples at 37° C. for 4 hours also resulted in greater heat sensitivity of the enzyme, than by storing the same samples at 4° C. for the same period of time.

A theory was advanced that perhaps enzymatic solubilization of xanthine oxidase from the milk microsomes causes the increase in heat sensitivity of xanthine oxidase in milk upon aging. Other possible explanations, however, were acknowledged.

The mechanisms involved in the increases in activities were believed to be distinctly different from those involved in increases in heat sensitivity. It was pointed out that increases in activities were attributed to dispersal of aggregates of microsomes, whereas increases in heat sensitivity were attributed to solubilization of the enzyme.

Microfilm \$2.75; Xerox \$4.00. 71 pages.

METABOLISM OF ALDRIN AND DIELDRIN
BY THE AMERICAN COCKROACH,
Periplaneta americana (L.).

(Order No. Mic 61-2259)

Eugene Ward Hamilton, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Paul A. Dahm

Data on the conversion of aldrin to dieldrin and other aldrin metabolites, *in vivo*, and the effect of selected nucleotides and an enzyme, peroxidase (horseradish), on the epoxidation of aldrin, *in vitro*, were obtained. The use of carbon-14 and chlorine-36 labelled aldrin and dieldrin, in conjunction with paper chromatography and radiotracer equipment, greatly aided in the detection of aldrin and its metabolites.

Two metabolites of aldrin were detected in the roach extracts: dieldrin and a ketone (metabolite K). Heretofore, only dieldrin had been reported as a metabolite of aldrin. Provisional identification of metabolite K (as extracted from sections of paper chromatograms containing the material) with a pure, synthesized dieldrin ketone was shown by a common band of absorbance at 5.72 microns on their infrared spectra. Cyclopentanone, a 5-carbon ring ketone, shows the same band of absorbance. There were also 6 other bands of absorbance, typical of an infrared spectrum of dieldrin, common to the two materials. However, the R_f value for the provided sample of dieldrin ketone did not agree with that obtained for metabolite K. R_f value determinations for a number of compounds similar to aldrin and dieldrin, except for the number and placement of the chlorine atoms, indicate that the R_f value is determined somewhat by the chlorine atoms. Thus, the difference in R_f values for metabolite K and dieldrin ketone could be a reflection on the number and placement of the chlorine atoms.

The formation of an inorganic chloride is indicated by apparent dechlorination of aldrin and its metabolites in the roach (as shown by differences in conversion detected with aldrin-C¹⁴ and aldrin-Cl³⁶); the presence of a product III in aldrin-Cl³⁶ standard solutions, and its absence in aldrin-C¹⁴ standard solutions; and the formation of significant amounts of III in peroxidase and/or DPN⁺ incubation mixtures containing aldrin-Cl³⁶, but not in mixtures containing aldrin-C¹⁴. The methylene bridge chlorines are especially labile. Therefore, the methylene bridge could be one of the reactive sites on the aldrin, dieldrin, or dieldrin ketone molecule. Another reactive site is obviously the double bond where the epoxide or ketone is formed.

The *in vitro* data showed that incubation mixtures containing peroxidase and/or DPN⁺, roach digestive tract, and aldrin resulted in the conversion of significant amounts of aldrin to dieldrin.

Microfilm \$2.75; Xerox \$4.00. 73 pages.

**ISOLATION AND KINETICS OF
TWO FORMS OF TORULA FUMARASE**

(Order No. 61-2959)

Selma Hayman, Ph.D.
The University of Wisconsin, 1961

Supervisor: Associate Professor Robert M. Bock

Two forms of fumarase, Fractions A and B, have been isolated from air-dried Torula yeast by means of column electrophoresis and diethylaminoethyl cellulose chromatography. Neither enzyme showed any sign of further fractionation upon repeated electrophoresis, and the two peaks were recovered when Fraction A and Fraction B were recombined and subjected to further electrophoresis. It was therefore concluded that the two enzymes did not interconvert during column electrophoresis.

Neither enzyme has been crystallized. Partition cell ultracentrifugation indicates that the two enzymes have identical sedimentation coefficients, $9.5 \times 10^{-13} \text{ sec.}^{-1}$.

The kinetic parameters, the Michaelis constants with malate (K_M) and fumarate (K_F) and the maximum velocities with fumarate (V_F) and malate (V_M), have been determined as a function of pH for the two yeast enzymes and for the previously well-studied pork heart fumarase. The K_M for Fraction A is consistently twice that for Fraction B and four times that for pork heart fumarase. The K_F for Fraction A is always higher than that for Fraction B, and that for pork heart fumarase is intermediate. The plots of V_M vs. pH for the two yeast enzymes are similar to that for pork heart fumarase, but the V_F plots are strikingly different. Whereas the plot of V_F vs. pH for pork heart fumarase has a bell-shape, neither of the V_F plots for the yeast enzymes does. Instead V_F appears almost insensitive to pH. There is merely a gradual decline in velocity with increasing pH.

The ionization constants of the free enzymatic site (K_{aE} and K_{bE}) and the apparent ionization constants of the enzyme-substrate complexes (K'_{aEM} , K'_{bEM} , K'_{aEF} and K'_{bEF}) have been calculated whenever possible. There are differences in the values of K'_{aEM} for the three enzymes and some differences in the other ionization constants. However, none of the differences are very large, and the only dramatic difference is the shape of the V_F plots for the yeast enzymes.

Microfilm \$2.75; Xerox \$4.80. 92 pages.

**THE ROLE OF Δ^1 -PYRROLINE-5-CARBOXYLIC
ACID IN THE BIOSYNTHESIS OF
PYRROLIDINE RING OF NICOTINE**

(Order No. Mic 61-2697)

Victor Krampl, Ph.D.
Michigan State University, 1961

Major Professor: Richard U. Byerrum

Ornithine-2-C¹⁴, glutamic acid-2-C¹⁴, proline-C¹⁴, and putrescine-1,4-C¹⁴ have been found to be efficient precursors for biogenesis of the pyrrolidine ring of nicotine. All these compounds exhibited an identical labeling

pattern in the nicotine molecule; namely, that the total radioactivity was found to be equally distributed between carbons 2 and 5 of the pyrrolidine ring. It has been established in microorganisms and mammals that Δ^1 -pyrrolidine-5-carboxylic acid (Δ^1 -PC-5) is an intermediate in the conversion of glutamic acid or ornithine to proline. Similar experimental evidence with respect to higher plants was not available. It was anticipated that Δ^1 -PC-5 could function also in higher plants in these transformations. The objective of this study was to investigate the participation of Δ^1 -PC-5 in the biosynthesis of nicotine.

Dl- Δ^1 -pyrrolidine-5-carboxylic acid-5-C¹⁴ has been synthesized, isolated as a hydrochloride and fed hydroponically to intact 3 months old tobacco plants.

Each plant received 1 to 2 mg of dl- Δ^1 -PC-HCl-5-C¹⁴, having the radioactivity of 2.0 to 4.0×10^6 c.p.m. The isolated nicotine was found to be radioactive. The specific activities varied between 4.5 and 0.6×10^4 c.p.m. per mmole, which corresponded to 0.14 to 0.02 per cent incorporation of the precursor. Variation in the incorporation of the precursor can be attributed to seasonal effects on the plants.

A "dry" feeding technique has been used for the administration of the precursor; namely, the total quantity of the precursor intended to be fed per plant, was administered in a single dose, in 1 to 2 ml solution. After the absorption of this volume to apparent dryness, three 1 to 2 ml aliquots of water followed, to achieve the highest possible uptake of the precursor. Approximately 40-50 per cent of the administered radioactivity after this treatment still remained unabsorbed. The precursor absorbed during the "dry" feeding period appeared to be the only material giving rise to the radioactivity found in nicotine. The remaining precursor in the nutrient solution was absorbed by the roots at a very slow rate. After expiration of the feeding period (7 days), approximately 25 per cent of the radioactivity originally fed to the plants was still recoverable. Scanning of the chromatograms and electrophorograms of the recovered residual feeding solution disclosed that the main peak of the recorded radioactivity still corresponded to that of the original solution fed. It could be tentatively suggested that one of the isomers of racemic Δ^1 -PC-HCl-5-C¹⁴ could be absorbed by the roots at a much slower rate than its optical antipode and that this isomer does not participate in the biosynthesis of nicotine. Another possibility to consider is the polymerization of dl- Δ^1 -PC-HCl-5-C¹⁴.

Degradation of the nicotine resulted in the isolation of carbons 2 and 5 of the pyrrolidine ring as barium carbonate possessing 30 and 30 per cent of the total radioactivity, respectively, and carbon from the N-methyl group of nicotine isolated as methyltriethylammonium iodide, having 29 per cent of the total radioactivity. The relatively high incorporation of radioactivity into the N-methyl group is the only significant difference from the labeling pattern obtained with other known precursors of the pyrrolidine ring of nicotine.

Equal distribution of the radioactivity between carbons 2 and 5 presupposes, a priori, the existence of a symmetrical intermediate, perhaps Δ^1 -pyrrolidine-5-C¹⁴ and Δ^1 -pyrrolidine-2-C¹⁴, which could result from the decarboxylation of dl- Δ^1 -PC-HCl-5-C¹⁴, followed by a shift of the double bond. This symmetrical intermediate could well be the ultimate precursor for biogenesis of the pyrrolidine ring of nicotine in tobacco plants.

Nicotine isolated from leaves, stems, and roots showed a ratio of specific activities 1:3:4, whereas the ratio of distribution of the nicotine (mg/g of dry matter) was 17:3:1, respectively. This result supports the previous finding that the roots of tobacco plants are the main site of nicotine biosynthesis and that the leaves serve as a depot for nicotine. Microfilm \$2.75; Xerox \$5.20. 105 pages.

**PREPARATION AND PROPERTIES OF
A RENAL PHOSPHATASE**

(Order No. Mic 61-1454)

Charlotte Rhett Lea, Ph.D.
Emory University, 1959

Director: Francis Binkley

A report from this laboratory in 1957 described a method of preparation of alkaline phosphatase of swine kidney in excellent yield and high order of purification;¹ those preparations had a specific activity of about 145,000. Further refinements of that purification procedure have resulted in preparations with specific activity as high as 170,000 to 180,000 units. The refinements included additional passes through Dowex 2 columns and redigestion to obtain preparations with specific activity of at least 35,000 before final passage through Dowex columns and sharper fractionations with barium ions and ethanol on more purified preparations with the final fractionation carried out at pH 8.6. These preparations have allowed the use of highly purified renal alkaline phosphatase to study the properties of the enzyme without need for extrapolation from less purified preparations or preparations which have lost a great deal of activity.

The highly purified enzyme was found to contain "pyrimidine pentose" and magnesium ions, but no phosphate. Hexosamine was found in one preparation but appeared to be absent in most of them. No known pyrimidine base could be detected in the highly purified enzyme preparations by studies of the ultraviolet spectrum of the enzyme at several pH values, before and after hydrolysis with 1 N hydrochloric acid. The ultraviolet spectrum at pH 8 was similar to that of ordinary proteins such as chymotrypsin or ovalbumin. The absorption of enzyme solutions was very little greater than would be expected on the basis of the "Lowry" protein content. Unlike ordinary proteins, however, the ultraviolet absorption of the enzyme solutions was nearly doubled after 2 hours hydrolysis with 1 N hydrochloric acid or 4.6 N perchloric acid.

The pH optimum of the highly purified enzyme was 9.4 to 9.6. The enzyme hydrolyzed all monoesters of orthophosphoric acid tested but released no phosphate from diesters on prolonged digestion with large amounts of enzyme. The enzyme was resistant to inactivation on digestion with hyaluronidase, ribonuclease, carboxypeptidase, aminopeptidase, and crystalline chymotrypsin and trypsin as well as the enzymes present in crude pancreatin and rattlesnake venom. Solutions of the highly purified enzyme were stable in the refrigerator with chloroform as a preservative for as long as two years. The enzyme was also stable to dialysis as long as the pH was maintained above 7, and there was no evidence for the existence of a co-

enzyme, either dialyzable or nondialyzable. The enzyme was activated by the divalent cations of manganese, cobalt, nickel and calcium in the absence of added magnesium ions but the activation by these metal ions was in all cases much less than that by the optimum concentration of magnesium ions (5×10^{-3} M). With the exception of calcium, these ions inhibited in the presence of magnesium ions. Zinc, cadmium and cupric ions and high concentrations of citrate or borate ions inhibited the enzyme. EDTA and cysteine inhibited the enzyme in high concentrations and activated in low concentrations; the activation reached a maximum of 200 percent. There was no activation by these compounds in the presence of magnesium ions. The effect of added amino acids was irregular; these ions either inhibited or protected against inhibition depending on the conditions of the assay.

1. Binkley, F., Alexander, V., Bell, F. E., and Lea, C., *J. Biol. Chem.*, **228**, 559 (1957).
- Microfilm \$2.75; Xerox \$6.60. 137 pages.

**THE TRANSAMINASE ACTIVITY OF
MUSCLE FROM MICE AND RATS
UNDERGOING DENERVATION ATROPHY
AND FROM MICE WITH
GENETIC MUSCULAR DYSTROPHY**

(Order No. Mic 61-2630)

Joseph Louis Magnani, Ph.D.
New York University, 1958

Adviser: Pinckney Jones Harman

Studies of the glutamic-oxaloacetic and glutamic-pyruvic transaminase systems of normal and atrophic rat muscle revealed no significant difference in activities on a unit weight basis. Experiments comparing the glutamic-oxaloacetic transaminase systems of normal and atrophic mouse muscles revealed that, as in the rat, no significant difference exists per unit muscle weight. Muscles from genetically dystrophic mice also showed no significant difference in glutamic-oxaloacetic transaminase activity per unit muscle weight from normal muscle.

Reevaluation of the data in terms of "muscle phase" discloses an increase in the glutamic-oxaloacetic transaminase and glutamic-pyruvic transaminase activities per unit "muscle phase" in atrophic rat muscle and an increase in the glutamic-oxaloacetic transaminase activity per unit "muscle phase" in both atrophic and dystrophic mouse muscle.

Although the "muscle phase" method of correcting readings has validity in terms of the actual volume per sample of "muscle phase" it has the disadvantage that another important factor is ignored; viz, the number of muscle fibers per sample.

Recalculation of data in terms of muscle fibers indicates a progressive decrease in the transaminase activity during the course of atrophy in the mouse and rat. Evaluation of the glutamic-oxaloacetic transaminase data from dystrophic mouse muscles presents a problem which cannot be resolved in the light of available information.

Additional evidence is provided in this study for the

necessity of evaluating biochemical data in terms of the alterations which occur in the tissue under investigation. The importance of interpreting chemical data not only in terms of unit weight, but also with respect to the relative volume of the active tissue and the cell numbers in such tissue is emphasized.

Microfilm \$2.75; Xerox \$3.00. 47 pages.

**STRUCTURAL STUDIES
ON THE β -LACTOGLOBULINS**

(Order No. Mic 61-2267)

Albert Peter Pfuderer, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Dr. L. S. Bartell

β -Lactoglobulins A and B have been isolated and crystallized. Fingerprints of the trypsin digestions of carboxymethyl A and B have revealed a glycine containing peptide on CMB that is absent in CMA. Preliminary amino acid analyses have shown that another peptide present in both fingerprints may contain valine in CMA and alanine in CMB.

A Moore and Stein column analysis of CMA and CMB disclosed 1.8 more moles of aspartic acid, 3.2 more moles of valine in CMA, and 1.7 more moles of glycine, 1.1 more moles of alanine in CMB per 35,500 M.W.

Optical rotatory dispersion measurements on B indicate its dispersion is very similar to mixed β -lactoglobulin. Experiments have indicated that its low levorotation may be caused by some sort of hydrogen bonded structure. This hydrogen bonded structure is not a typical α -helix since it does not have the anomalous dispersion characteristic of helical polyamino acids.

The small amount of anomalous dispersion present in β -lactoglobulin, measured by either b_o or λ_c , will vanish when the molecule is unfolded in ways which do not cause a large change in specific rotation and do not specifically attack hydrogen bonds.

The amount of hydrogen bonding in β -lactoglobulin has been estimated using water adsorption data. A new method of calculating the amount of hydrogen bonding in the peptide imido group from I. R. spectra has been suggested and an equation which relates the two measures of anomalous dispersion, λ_c and b_o , has been derived.

Microfilm \$2.75; Xerox \$6.20. 127 pages.

**BIOCHEMICAL STUDIES OF
CELLULAR PROLIFERATION.
THE POSSIBLE ROLE OF ALDOLASE AND
DEOXYRIBOSE PHOSPHATE ALDOLASE.**

(Order No. Mic 61-2446)

Henry George Roscoe, Ph.D.
Cornell University, 1961

The contribution of the glycolytic pathway to mitotic division was studied in rat mammary gland tissue under-

going active cellular proliferation. The activity of the enzyme aldolase was used as a measure of over-all glycolytic capacity. It was found that there was a high degree of correlation between aldolase activity and active cellular proliferation in rat mammary gland tissue during pregnancy. This fact coupled with the finding that phosphorylation is uncoupled from oxidation in mitochondria isolated from preparturient guinea pig mammary gland tissue (Ciaccio E.I., Thesis (Ph.D.), Cornell Univ., 1959), suggested that the glycolytic pathway could satisfy the energy requirements for mitotic division in this tissue.

The pathway by which deoxyribose is synthesized by mammalian tissues was also investigated. The enzyme deoxyribose phosphate aldolase (DR-alcoholase) which catalyzes the reversible aldol condensation of acetaldehyde with glyceraldehyde-3-phosphate to form deoxyribose phosphate, was purified from rat liver by ammonium sulfate fractionation. The purified enzyme showed an absolute requirement for crystalline aldolase when fructose 1,6 diphosphate was used as the source of glyceraldehyde-3-phosphate. The pH optimum of the purified DR-alcoholase varied with the buffer system. In tris (hydroxymethyl) amino methane (Tris) or histidine buffer, the pH optimum was between 6 and 7; in phosphate buffer, between 5.5 and 6 and in acetate-phosphate buffer maximal activity was found at pH 6.5. The activity of the purified enzyme was enhanced by inorganic phosphorus and acetate. Its activity, when assayed in an acetate-phosphate buffer, was five times greater than in histidine buffer alone. The addition of cysteine or glutathione had no effect on the activity of DR-alcoholase. On the other hand, 1×10^{-4} Molar para-chloromercuribenzoate (PCMB) completely inactivated the purified enzyme and 1.8×10^{-4} Molar N-ethyl maleimide caused a 50 percent reduction in activity. The inhibition by PCMB was found to be reversible by cysteine. These findings suggested that free sulfhydryl groups were required for the activity of the purified enzyme.

The product of the condensation reaction catalyzed by DR-alcoholase was isolated and purified as its barium salt. The product was found to contain one mole of organic phosphorus per mole of deoxyribose and was found to be indistinguishable from authentic deoxyribose-5-phosphate by paper chromatography.

The reaction catalyzed by the purified DR-alcoholase was found to be reversible and both acetaldehyde and triose phosphate were formed upon incubating either the isolated reaction product or deoxyribose-5-phosphate with the purified enzyme.

It was also found that homogenates of rat liver were capable of forming deoxyribose phosphate from ribose-5-phosphate providing acetaldehyde was present. Subsequent purification showed that ribose-5-phosphate was first cleaved to triose phosphate which then condensed with acetaldehyde to form deoxyribose phosphate.

DR-alcoholase activity was measured in homogenates of rat mammary gland tissue in different stages of development. The enzyme could not be detected in this tissue during the period of active mitotic division. However, at the tenth day of lactation, the enzyme was easily detected. Although no mitotic division occurs at this stage of development, cellular destruction has been reported. In view of this fact, it was suggested that DR-alcoholase is important in the breakdown of deoxyribose rather than in the synthesis of this sugar.

Microfilm \$2.75; Xerox \$4.20. 76 pages.

**THE APPLICATION OF
GAS CHROMATOGRAPHIC TECHNIQUES
TO THE STUDY OF VOLATILE COMPONENTS
IN CHEDDAR CHEESE**
(Order No. Mic 61-2440)

Richard John Scarpellino, Ph.D.
Cornell University, 1960

A method has been developed for concentrating the volatile organic compounds in ripened cheese for gas chromatographic analysis. The method consists of a rapid churning of a cheese slurry at room temperature and centrifugation of the resulting heated butter. The dry aromatic oil which is obtained is subjected to high vacuum distillation and the distillates are fractionated. With fully mature Blue cheese, an organic layer separates from the distillate and is easily isolated and dried. With Cheddar cheese and immature Blue cheese, the distillates are extracted with ether and the extract evaporated in the presence of a small amount of high boiling solvent, benzyl alcohol, which acts as a carrier for the volatiles to be analyzed. For the analysis of certain compounds, the distillate may also be used directly, without fractionation.

The developed technique was applied to the study of the volatile compounds in raw and pasteurized Cheddar cheese during the ripening process. The major volatile compounds in both types of Cheddar cheese are acetic acid, butyric acid, ethanol, methyl ethyl ketone, and secondary butyl alcohol. Acetyl methyl carbinol and diacetyl are also present, generally at trace levels. The time of appearance and quantitative changes of these compounds during ripening is described. The difference in the fermentation pattern between the two types of cheese was that all the changes in the pasteurized cheese took place at a much slower rate than in the raw milk cheese and at usually lower concentrations. A hitherto unreported biochemical pathway concerning the formation of methyl ethyl ketone and secondary butyl alcohol is hypothesized.

The aroma of an aqueous solution of acetic acid, butyric acid, methionine and methyl ethyl ketone is similar to the aroma of ripened Cheddar cheese. However, the quality of this synthetic aroma in successive preparations is subject to an unexplained variation.

Microfilm \$2.75; Xerox \$3.60. 63 pages.

**EFFECTS OF X-RADIATION ON
TUMOR GLYCOLYSIS, WITH CHARACTERIZATION
OF SOME AROMATIC ALPHA-KETO ACID
HYDRAZONES FOR THEIR
ANALYTICAL APPLICATIONS.**

(Order No. Mic 61-1108)

Ambrose Masanobu Tokushige, Ph.D.
Institutum Divi Thomae Foundation, 1961

A. Tumor glycolysis and X-radiation.

1. *In vitro* X-irradiation of S-37 tumor or its homogenates with a total of 1600 r in 10 minutes caused a considerable stimulation of anaerobic glycolytic activity in its homogenates at pH 7.8, while no sig-

nificant effect was observed at pH 7.4, in terms of glucose utilization, and carbon dioxide and lactic acid formation.

2. There was no alpha-keto acid produced in the glycolytic process, and also there was no significant change of total keto acid level between irradiated and non-irradiated samples.
3. Parallel to this phenomenon, the ATPase activity of the tumor homogenates was also stimulated by the same dosage of X-irradiation at pH's from 7.4 to 9.8 both in veronal and glycine buffers. Bicarbonate buffer gave a similar result at pH 9.0.
4. The tumor ATPase in homogenates was more activated by Mg than by Ca. It was also activated at 10^{-4} - 10^{-5} M-EDTA; however, it was 50% inhibited by 10^{-3} M.
5. On the contrary, myosin ATPase prepared from rabbit muscle was inhibited by the X-irradiation in the presence of Mg and Ca, while ATPase in homogenates was still stimulated under the same conditions.
6. Irradiated tumor homogenates raised the ATPase activity of non-irradiated myosin ATPase.
7. Electrolytic conductivity measurements of irradiated and non-irradiated tumor homogenates did not show any significant difference.
8. Considering these results, tumor ATPase seems to be activated by some non-ionic factors -- probably some free radicals -- which are produced in the homogenates by the X-radiation. Furthermore, the activation of ATPase accelerates the hydrolysis of endogenous ATP in cytoplasm where most of the glycolytic enzymes are present; replenishing the exhausted ATP by external ATP accelerates all the glycolytic reactions.

B. Keto acid hydrazone characterization.

1. Oxaloacetic acid- and acetoacetic acid-2,4-dinitrophenylhydrazones underwent thermal decarboxylation by heat after resolidification and were converted to pyruvic acid and acetone hydrazones, respectively. Therefore, melting points for these keto acid hydrazones are not reliable.
2. The *cis* isomer of pyruvic acid hydrazone was converted to the *trans* isomer by heat after a resolidification. A melting point cannot be given for the *cis* isomer.
3. 2,4-Dinitrophenylhydrazones of phenylpyruvic, p-hydroxyphenylpyruvic, indole-3-pyruvic, p-methoxyphenylpyruvic, phenylglyoxylic, p-methoxyphenylglyoxylic, and β -imidazole glyoxylic acids were prepared and their geometric isomers were separated and characterized by paper chromatography, melting point, crystal form, and nickel reaction, and by their visible, infrared, and N.M.R. spectra in some cases.
4. Generally, *cis* isomers of the aliphatic keto acid hydrazones are less stable and have lower melting point than *trans*, whereas *trans* isomers are less

stable and have a lower melting point than the cis isomer of the aromatic keto acid hydrazones.

5. It was found that the nickel reaction which differentiates pure cis isomers of keto acid hydrazones from trans isomers is applicable for differentiation of isomeric spots on paper chromatograms.
6. By applying the new method of nickel reaction together with thermal isomerization, the cis and the trans isomers of pyruvic acid hydrazone in a sample from tumor glycolytic experiments, and likewise the pyruvic acid hydrazone isomers and the cis and the trans isomers of phenylpyruvic acid hydrazone from mouse urine, were well identified.

Microfilm \$2.75; Xerox \$5.80. 118 pages.

A gravimetric method of analysis for tetrazoles was developed and applied to the analysis of the solid complexes.

Microfilm \$2.75; Xerox \$6.00. 121 pages.

CHEMISTRY, INORGANIC

A STUDY OF THE COPPER (II) AND NICKEL (II) COMPLEXES OF SOME 5-SUBSTITUTED TETRAZOLES

(Order No. Mic 61-2685)

Ned Arthur Daugherty, Ph.D.
Michigan State University, 1961

Major Professor: Carl H. Brubaker, Jr.

A study of the copper (II) and nickel (II) complexes of some 5-substituted tetrazoles was made. In all of the cases studied, the tetrazoles coordinated as tetrazolate anions. The maximum number of tetrazoles that can coordinate per metal ion appears to be two.

Three crystalline copper complexes of 5-phenyltetrazole having the formulae $\text{Cu}(\text{C}_7\text{H}_5\text{N}_4)_2 \cdot \text{H}_2\text{O}$, $\text{Cu}(\text{C}_7\text{H}_5\text{N}_4)\text{OH}$, and $\text{Cu}(\text{C}_7\text{H}_5\text{N}_4)\text{Cl}$ were prepared and characterized. Several other crystalline copper complexes of 5-aryltetrazoles were also prepared and characterized. In general, the copper complexes are hygroscopic, insoluble in a wide variety of solvents, and sensitive to heat.

The anion of the copper salt used was found to have an unusual effect on the formation of the solid complexes. The anion effect was investigated for the reactions of copper (II) ion with 5-aminotetrazole.

The reported acid-induced decomposition of the copper (II)-5-aminotetrazole complexes was studied. It was found that the extent of decomposition was very slight.

The nickel complexes of several tetrazoles were isolated as solids. The solid nickel complexes were poorly characterized, amorphous solids, containing 1.5-1.9 tetrazoles per nickel. The magnetic susceptibility of the nickel complex of 5-aminotetrazole was measured. The solid is paramagnetic.

A study of the nickel complexes in solution was carried out. There is strong evidence for the existence of ions corresponding to the formula Ni_2T_3^+ (T = a tetrazolate ion) in solution.

The visible spectra of the nickel complexes suggest that the complexes are cubic in solution.

PREPARATION OF SILOXY-CHROMIUM COMPOUNDS

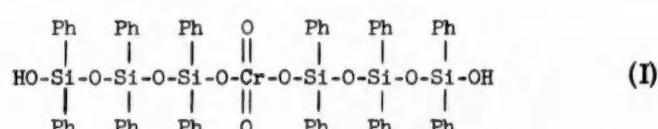
(Order No. Mic 61-2695)

Curtis Robert Hare, Ph.D.
Michigan State University, 1961

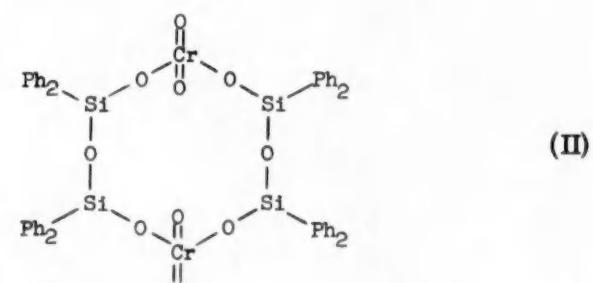
Major Professor: Robert N. Hammer

The purpose of this investigation was the preparation of inorganic heteropolymers containing silicon and hexavalent chromium. Prior to the preparation of the heteropolymers, a series of bis(triorganosilyl)chromates were prepared to study the effects of the silicon substituents on the stability of the silicon-oxygen-chromium(VI) linkage. The preparation of these silylchromates was carried out by reaction of the corresponding silanol with chromium(VI) oxide in methylene chloride. The silylchromates prepared and characterized were bis(p-tolyldiphenylsilyl)chromate, bis(tricyclohexylsilyl)chromate, and bis(cyclohexyldiphenylsilyl)chromate; the probable preparation of bis(methyldiphenylsilyl)chromate was also carried out. The compound bis(triphenylsilyl)chromate was prepared and characterized in this investigation prior to discovery of a brief description of its synthesis in the patent literature. These silylchromates decompose in light and when heated above their melting points. The most stable is bis(triphenylsilyl)chromate; aliphatic groups reduce the thermal stability. The new silanol cyclohexyldiphenylsilanol was prepared by the reaction of cyclohexyllithium and diphenylchlorosilane in petroleum ether.

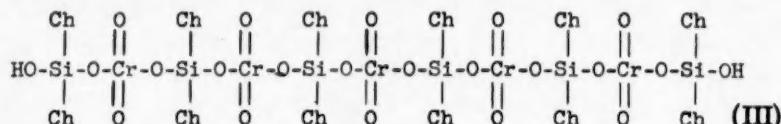
Reaction of either chromium(VI) oxide or chromyl chloride with diphenylsilanol gives a mixture of two siloxy-chromium compounds and siloxane impurities. The complete separation of the chromium compounds was difficult. Compound I is a yellow-brown, brittle, glassy solid which is easily melted to a viscous fluid. The structure of this compound is (Ph = phenyl):



Compound II is a yellow-orange, crystalline solid with structure:



Studies of the reactions of either chromium(VI) oxide or chromyl chloride with the siloxane condensation products of diphenylsilanediol as well as of the reaction of compound II with the diol enabled postulation of a mechanism for the formation of compounds I and II. Dicyclohexylsilanediol reacts with chromium(VI) oxide in methylene chloride to give a dark red, amorphous solid with the structure (Ch = cyclohexyl):



Compounds I and III are believed to be the first compounds of their kind to be isolated and identified. Compound II is believed to be the first reported cyclic siloxane containing chromium. Compound III decomposes on standing, compound II has a sharp decomposition point at 169°C, and differential thermal analysis of compound I indicates decomposition at 275°C, which leads to the conclusion that increased chromium(VI)-to-silicon content in chromium(VI) heterosiloxanes brings on reduced thermal stability. Ultraviolet and visible spectra of the compounds prepared suggest an interaction involving the substituents of the silicon atom with the chromate group. The infrared absorption of the silylchromates in the 11.4-11.5μ region was tentatively assigned to the chromium-oxygen-silicon linkage.

Microfilm \$2.75; Xerox \$6.60. 140 pages.

mation of adducts having the general formula $[\text{M}\{\text{Ni}(\text{NH}_2-\text{CH}_2\text{CH}_2\text{S})_2\}_2]^{n+}$, where $\text{M} = \text{Cu(II)}, \text{Cu(I)}, \text{Pd(II)}, \text{Pt(II)}$, and Cd(II) . Magnetic studies, conductivity measurements, and spectrophotometric continuous variations studies—all support the assignment of a structure similar to that proposed for the corresponding homometallic nickel(II) complex.

Bis(2-aminoethanethiolo)palladium(II), $[\text{Pd}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2]$, was observed to behave in a manner analogous to that of the corresponding nickel(II) compound in the presence of aqueous solutions of NiCl_2 and K_2PdCl_4 , resulting in the formation of $[\text{Ni}\{\text{Pd}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2\}_2]\text{Cl}_2 \cdot 2\text{H}_2\text{O}$ and $[\text{Pd}\{\text{Pd}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2\}_2]\text{Cl}_2$, respectively. The last example in this series of compounds is the homometallic cobalt(II) trimer, $[\text{Co}\{\text{Co}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2\}_2]\text{Cl}_2$. The magnetic moment of 2.49 Bohr Magnetons calculated per cobalt(II) atom is consistent with the values observed for cobalt(II) complexes of other sulfur-containing ligands, and this substance would be expected to involve square planar cobalt(II).

Solubilization of the normally difficultly soluble tris cobalt(III) complex, $[\text{Co}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_3]$, in an aqueous solution of cobalt(II) or bromopentamine cobalt(III) and nickel(II) salts resulted in the formation of trimeric complexes which are best isolated in the form of bromide salts. These solids exhibit a stoichiometry of 2 Co(III) atoms : 1 Co(III) or Ni(II) : 6 ligands. The magnetic moment of 3.23 Bohr Magnetons (solid sample) for the Ni(II) adduct is in agreement with octahedral coordination about the Ni(II) and provides the most pertinent information about the probable structure of these adducts. In view of the absence of halide coordination in $[\text{Ni}\{\text{Ni}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2\}_2]\text{Cl}_2$ and related adducts, a structure involving the coordination of Ni(II) through six sulfur atoms of two $[\text{Co}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_3]$ molecules is most likely. Only the facial isomer of $[\text{Co}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_3]$ possesses the proper geometry for the formation of this structure. It is further suggested that the diamagnetic cobalt(III) adduct would also show a preference for this type of structure and would thus be formulated as the tris-uni-electrolyte, $[\text{Co}\{\text{Co}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_3\}_2]\text{Br}_3$.

The complexes of methyl-2,2'-dimercaptodiethylamine and 2,2',2"-trimercaptotriethylamine with several metal ions have also been studied. In the case of the former ligand, Ni(II) and Pd(II) form stable uncharged complexes of the type $[\text{M}_2\text{L}_2]$; however, several anomalies in the structures of the Co(II) complex and the complexes of 2,2',2"-trimercaptotriethylamine remain unexplained.

Part I

Well-defined monomeric complexes of nickel(II), palladium(II), and cobalt(III) have been prepared with 2-aminoethanethiol. The diamagnetic bis(2-aminoethanethiolo)nickel(II), $[\text{Ni}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2]$, is formed from basic aqueous solution and exhibits a very slight solubility in both polar and nonpolar solvents. Nickel(II) also forms a second compound, $[\text{Ni}\{\text{Ni}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2\}_2]\text{Cl}_2$. This compound is diamagnetic, indicating that all three nickel atoms are contained in planar coordination polyhedra. The trimer exhibits the usual properties of a salt and is readily prepared from aqueous solution, either by reaction of the ligand and metal ion or by the solubilization of bis(2-aminoethanethiolo)nickel(II) with nickel chloride. A structure involving a third nickel atom utilizing to full advantage the strong donor properties of the coordinated sulfur atoms of two uncharged *cis*-bis(2-aminoethanethiolo)nickel(II) molecules is consistent with the preparation and properties of this compound.

Aqueous solutions of other metal salts react in a similar manner with $[\text{Ni}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2]$, resulting in the for-

Part II

The coordinated sulfur atoms in $[\text{Ni}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2]$ and $[\text{Pd}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S})_2]$ were found to retain the reactivity associated with the uncomplexed ligand. Alkylation of the coordinated sulfur atom provides a significant example of an addition reaction occurring at a coordinated donor atom without cleavage of the metal-donor bond. The resulting Ni(II) complexes have the general formula $[\text{Ni}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S}-\text{R})_2\text{X}_2]$, where R may be $-\text{CH}_3$ or $-\text{CH}_2\text{C}_6\text{H}_5$ and X may be Cl^- , Br^- , or I^- . Octahedral configurations are suggested by the magnetic moments which are 3.1 to 3.2 Bohr Magnetons. The palladium(II) complex undergoes alkylation with methyl iodide to form $[\text{Pd}(\text{NH}_2\text{CH}_2\text{CH}_2\text{S}-\text{CH}_3)\text{I}_2]$; however, the use of benzyl bromide with the palladium(II) complex resulted in a

product with a composition suggestive of a mixture which was not separated.

The nickel(II) complex of methyl-2,2'-dimercaptodiethylamine also undergoes alkylation with methyl and benzyl halides; however, the assignment of a simple structure is somewhat more tenuous than in the case of the 2-aminoethanethiol complexes.

The reaction of bis(dimethylglyoxime)nickel(II), $[Ni(DMG)_2]$, and bis(dimethylglyoxime)palladium(II), $[Pd(DMG)_2]$, with acetyl and benzoyl chloride has also been investigated. The acylation process appears to proceed stepwise, the first step completely destroying the starting material, producing only $[M(HDMG)Cl_2]$ and $DMG-(COCH_3)_2$. In the case of the nickel(II) complex, a second step involving the acylation and removal of the remaining molecule of dimethylglyoxime was also observed.

Microfilm \$3.15; Xerox \$11.05. 241 pages.

SOME CHEMICAL PROPERTIES OF THE SILICON SUBCHLORIDES

(Order No. Mic 60-4689)

Alexander Kaczmarczyk, Ph.D.
Washington University, 1960

Chairman: Associate Professor Grant W. Urry

1. The photochemical reaction between disilicon hexachloride and ethylene, induced by ultraviolet radiation, was investigated.

2. The reaction between disilicon hexachloride and mercury (II)cyanide was studied. Trichlorocyanosilane, Cl_3SiCN , the first reported mixed halocyanide of silicon, was prepared and characterized.

3. The reaction between disilicon hexachloride and trimethyl amine was studied under various conditions. The formation of complexes between disilicon hexachloride and trimethyl amine at lower temperatures was investigated.

4. A new one-step synthesis of Si_6Cl_{14} from Si_2Cl_6 , in quantitative yields, is described. Hexasilicon tetradecachloride, Si_6Cl_{14} , was characterized, and its reactions with dimethyl zinc, trimethyl amine, and methyl alcohol were investigated. The complexes of Si_6Cl_{14} with $SiCl_4$ and $SiHCl_3$ were examined.

5. The preparation of a yellow silicon subchloride with the composition $(Si_1Cl_{1.8})_x$ was studied. The reactions of this subchloride with anhydrous HCl and with methyl alcohol are described.

Microfilm \$2.75; Xerox \$4.20. 80 pages.

COMPLEXES OF METAL IONS WITH 2-PYRIDINALHYDRAZONES AND 2-PYRIDINALIMINES

(Order No. Mic 61-2845)

Martin Alvin Robinson, Ph.D.
The Ohio State University, 1961

The complexes of iron(II), cobalt(II), and nickel(II) with 2-pyridinalmethyl-, dimethyl-, phenyl-, and diphenylhydrazone as well as 2-pyridinal-iso-propyl- and benzyl-imine have been synthesized. The compounds have been characterized by magnetic moments, molar conductances, and infrared, visible, and ultraviolet spectra. In addition, a few compounds involving copper(II), palladium(II), zinc(II), cadmium(II), and mercury(II) with the aforementioned ligands were prepared in order to facilitate better understanding of the nature of the complexes containing ligands of the dimethine type.

The majority of the complexes that were obtained were of two types. The first group of complexes were of the general formula $[M^{II}L_2X_2]$, where M is a divalent metal ion, L, a bidentate ligand, and X, a univalent anion. These compounds exhibit maximum paramagnetism as well as low crystal field splitting parameters (Dq). Both observations are consistent with spin-free octahedral structures. In addition, the molar conductances are those expected for partial or complete solvolysis to produce di-univalent electrolytes in methanol.

The second set of compounds was of the general formula $[M^{II}L_3]X_2$. These complexes were all di-univalent electrolytes, and the magnetic moments and crystal field splitting values of the cobalt(II) and nickel(II) complexes fall within the ranges usually associated with spin-free octahedral structures. The iron(II) complex with 2-pyridinalmethylhydrazone exhibits diamagnetism, a property which is typical of compounds of this type. In contrast, the iron(II) complex with 2-pyridinaldimethylhydrazone is paramagnetic ($\mu_{eff.} = 5.45$ B.M.). Values for the crystal field splitting parameters demonstrate that the coordinating ability of the dimethylhydrazone derivative is much smaller than that of similar ligands. This behavior, and the failure of the phenyl- and diphenylhydrazone analogs to form the corresponding three-to-one complexes with iron(II), cobalt(II), and nickel(II), provided the basis for further investigation.

The ultraviolet spectra of the ligands demonstrate that the positions of the absorption maxima are dependent upon the substituent groups attached to the terminal nitrogen atom. This shift is consistent with the expectation of resonance throughout the molecule, which would be enhanced by an increase in the number of alkyl groups on the terminal nitrogen atom. The visible spectra of the tris iron(II) complexes with the alkylhydrazone ligands indicate that the metal ion-ligand charge transfer transition occurs at an unusually high energy in the case of the dimethylhydrazone derivative. This indicates that bonding of the $d\pi-p\pi$ type is much less important for the dimethylhydrazone derivative than for either the hydrazone or methylhydrazone derivative, and is indicative of a lengthening in the sigma bond distance between the central metal ion and the imine nitrogen atom of the ligand.

Interpretation of the infrared spectra of the ligands and complexes offers support for this view. The position of the C=N vibrational mode in the spectra of the free

ligands provides direct evidence for resonance interaction of the electron pair on the terminal nitrogen atom with the remainder of the molecule. This, in turn, requires that the -NRR' group be coplanar with the entire molecule. Spectral evidence also supports the view that the ligands retain this coplanar configuration upon complexing. In the case of dimethylhydrazone derivatives, one of the CH₃ groups is thereby brought into close proximity to the metal ion. The associated steric relationships require that the sigma bond between the central metal ion and the ligands in the complexes of 2-pyridinaldimethylhydrazone lengthen in order to accommodate the terminal methyl group. This results in a decrease in stability and, therefore, provides an explanation for the impaired complexing ability of this ligand, as demonstrated by the paramagnetism and short wave length charge transfer spectrum exhibited by the tris iron(II) complex. Similar but more extreme relationships exist among the phenyl derivatives.

Microfilm \$2.75; Xerox \$9.25. 204 pages.

**THE INTERACTION OF DIBORANE
WITH METAL BOROHYDRIDES
AND BORANE AMINES**

(Order No. Mic 61-2517)

William James Wallace, Ph.D.
Purdue University, 1961

Major Professor: Herbert C. Brown

The solubility of diborane in several ethers has been determined. Diborane dissolves in butyl ether according to Henry's Law without dissociation of the diborane molecule. In diglyme (diethylene glycol dimethyl ether) the solubility is enhanced by partial dissociation of the diborane in solution. The extent of this dissociation increases with decreasing temperature. In tetrahydrofuran, this dissociation is complete. The diborane solutions in diglyme and tetrahydrofuran conduct the electric current, whereas the butyl ether solution does not conduct.

The stability of the borohydride ion formed by the addition of a borane group to the borohydride ion is comparable to the stability of the hydrogen bond. Conductivity data indicates that formation of the diborohydride markedly increases the mobility of the ions in diglyme solution. Deuterated diborane exchanges rapidly with the borohydride ion through formation of the diborohydride ion. Formation of the diborohydride in tetrahydrofuran seems to be in competition with formation of the tetrahydrofuran-borane addition compound.

When diborane and deuterated diborane mixtures are reacted with benzophenone in tetrahydrofuran solution, the benzhydrol produced contains very nearly the same ratio of hydrogen and deuterium in the alpha position of the benzhydrol as was contained in the diborane mixture. The mixture of benzhydrols may be analyzed by the infrared absorption at 3.48 microns and 4.69 microns. The low isotope effect in the reduction reaction makes it possible to analyse mixtures of diborane and deuterated diborane by means of the infra-red spectra of the benzhydrol obtained by reacting the diborane with benzophenone.

Attempts to prepare pyridine-diborane in diglyme were

unsuccessful. However, it was found that pyridine-borane does undergo exchange of deuterium with deuterated diborane. Microfilm \$2.75; Xerox \$9.00. 198 pages.

CHEMISTRY, ORGANIC

**REACTION OF SODIUM MERCAPTIDES
AND SODIUM HYDROSULFIDE WITH ESTERS**

(Order No. Mic 61-2735)

Jacob Bruce Baumann, Ph.D.
University of Michigan, 1961

Because of the lack of a systematic study of the alkyl cleavage of carboxylic esters by ions containing bivalent sulfur and due to the interesting nature of the displacement itself, an investigation was undertaken into the scope of the reaction.

Sodium hydrosulfide, of historical significance, was abandoned almost at once in favor of sodium n-propyl mercaptide. The reactions were carried out under nitrogen, and initially the alcohol corresponding to the alkyl group of the ester was used to avoid transesterification, which was shown to be more rapid than the displacement by mercaptide. Thus alkyl-oxygen fission was demonstrated for ethyl, n-propyl, and cyclohexyl benzoates. N,N-Dimethylformamide (the solvent of choice), N-methylacetamide, and 2,2'-dimethoxydiethyl ether were then used as solvents and methyl mesitoate and methyl, t-butyl, and t-amyl benzoates were the substrates, all of which underwent alkyl-oxygen fission, as determined qualitatively.

Sodium benzyl mercaptide was utilized to facilitate isolation of the product sulfides as crystalline sulfones. Methyl benzoate yielded methyl benzyl sulfide, but iso-propyl benzoate and t-butyl benzoate gave only dibenzyl sulfide. The increased branching of the alkyl group was postulated as changing the route of reaction to carbonyl attack, forming benzyl thiolbenzoate, which then underwent alkyl fission, yielding dibenzyl sulfide and sodium thiolbenzoate.

Sodium n-propyl mercaptide and sodium cyclohexylmethyl mercaptide were less susceptible to branching effects, presumably due to their greater nucleophilicity.

Benzyl thiolbenzoate yielded dibenzyl sulfide with sodium benzyl mercaptide in N,N-dimethylformamide at reflux and yielded n-propyl thiolbenzoate with sodium n-propyl mercaptide at 34°.

Kinetic determinations were carried out in N,N-dimethylformamide using sodium n-propyl mercaptide. Rate constants for second order alkyl fission were determined to be 5.33×10^{-2} liters/mole/min. at 29.50° and 12.20×10^{-2} liters/mole/min. at 34.15° for methyl mesitoate; while that for methyl benzoate at 29.50° is 9.18×10^{-2} liters/mole/min. The activation energy for the former reaction is 32.9 kcal./mole and the activation entropy is -5.28 cal./mole/deg. Neopentyl benzoate does not react at either temperature.

Microfilm \$2.75; Xerox \$5.20. 104 pages.

PYROLYtic AND BASE-CATALYZED
ELIMINATION REACTIONS:
EFFECT OF STRUCTURE ON
THE RATE OF REACTION.

(Order No. Mic 61-2253)

Charles Anthony Bishop, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Charles H. DePuy

The base-catalyzed elimination reaction of a series of meta and para substituted 2-phenylethyl iodides, bromides and tosylates with t-butoxide ion in t-butyl alcohol and with ethoxide ion in t-butyl alcohol was investigated and compared with earlier work on these compounds using ethoxide ion in ethanol. The Hammett ρ -value was calculated in each case and, for the tosylates, was found to increase from 2.3 in ethoxide-ethanol to 3.4 in t-butoxide-t-butanol while the halide ρ -values remained the same (~2.1). That the change in ρ -value observed for the tosylates was primarily due to the strength of the base was shown by conducting the experiments in t-butyl alcohol using ethoxide ion as base. Here, the bromide and iodide ρ -values again remained the same while the tosylate ρ -value dropped to 2.6, almost its value in ethoxide-ethanol. The results indicate that the halides probably have more double bond character in the transition state, the halide leaving group being better able to relieve negative charge generated on the β -carbon atom in the transition state.

The diminished reactivity of the tosylate group in elimination reactions (compared with solvolytic reactions) was demonstrated not only in the 2-phenylethyl system, but also in simple aliphatic systems. This behavior was explained by postulating a variation in resonance and inductive stabilization of the anion with differences in carbon-oxygen bond breaking.

The rates of reaction of substituted 2-phenylethyl chlorides and fluorides were also measured using ethoxide ion in ethanol. Among the halides, an increase in the rate of reaction and a decrease in ρ -value in going from fluoride to iodide was explained in terms of carbon-hydrogen bond breaking and carbon-halogen bond strength.

The relative reactivities of the 2-phenylethyl chlorides, bromides and tosylates were compared with their reactivities in other alkyl systems. It was shown that the tosylate becomes progressively less reactive compared to the bromide and chloride as the β -hydrogens become more acidic, again demonstrating that the tosylate group cannot relieve negative charge generated on the β -carbon atom in the transition state as well as the halides.

The olefin distributions and relative rates of reaction in the pyrolysis of some substituted esters and other derivatives of sec-butyl alcohol were determined. This work contrasted for the first time a variety of pyrolytic *cis* eliminations in the same system. The results showed the absence of large inductive effects due to changes in substituents in the ester group and thus emphasized the concerted nature of the reaction. Compared to the acetate, little change in olefin distribution was observed for the vinyl ether, acetamide and xanthate showing that these derivatives likely undergo pyrolytic elimination by a mechanism similar to esters.

Microfilm \$2.75; Xerox \$5.00. 100 pages.

A STUDY OF THE DECOMPOSITION OF
AMMONIUM HEXANITRATOCERATE(IV)
IN GLACIAL ACETIC ACID

(Order No. Mic 61-2679)

Leo Henry Bowman, Ph.D.
Michigan State University, 1961

In the course of using acetic acid solutions of ammonium hexanitratocerate(IV), as an oxidizing agent for the determination of organic functional groups, it has been observed that this reagent is somewhat unstable when exposed to light, that relatively rapid decomposition occurs upon the addition of mineral acids, and that at no time has there been any evidence of gaseous products produced during this decomposition.

Efforts to define the observations above were somewhat stymied by the complexity of the system, ammonium hexanitratocerate(IV) in a solution of perchloric acid and water in glacial acetic acid. Physical-chemical techniques, however, have provided some insight into the solvolytic reactions occurring, eliminated free radical mechanisms from consideration, and suggested that the enol form of acetic acid might be the reductant responsible for decomposition of the cerium(IV) state.

The reaction kinetics have also been determined. The reaction appears to follow the rather simple kinetics of:

$$\frac{d[\text{Ce}]}{dt} = k \frac{[\text{Ce}][\text{HClO}_4]^2[\text{HOAc}]^n}{[\text{H}_2\text{O}]}$$

The instability of the reagent in the presence of mineral acids circumvents the use of excess reagent followed by back titration of the unreacted cerium(IV). This limitation severely narrows the scope of the utility of this solution as an analytical reagent by requiring that an oxidation be very rapid, so that a direct titration can be employed. Attempts to determine glycolic acid and acetoxyacetic acid were unsuccessful due to the slowness of the oxidation, succinic acid was not attacked by the reagent, and acetoacetic ester and sodium glyoxylate were rapidly oxidized.

Microfilm \$2.75; Xerox \$4.20. 79 pages.

A STUDY OF THE REACTIONS OF
TERTIARY ALIPHATIC HYPOCHLORITES
WITH TRISUBSTITUTED PHOSPHINES
AND PHOSPHITES

(Order No. Mic 61-2181)

Roland Ralph DiLeone, Ph.D.
Rutgers University, 1961

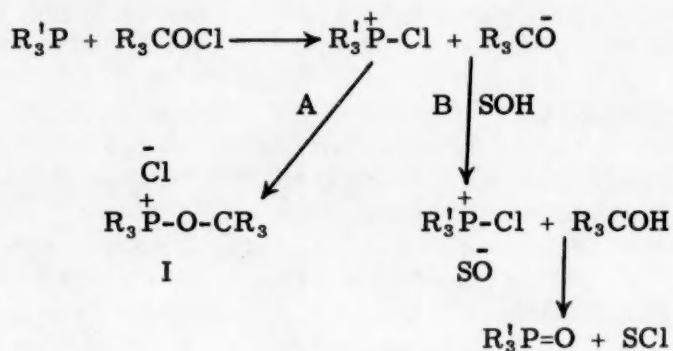
Major Professor: Donald B. Denney

Trisubstituted phosphines or phosphites and t-alkyl hypochlorites react rapidly to give t-alkyl chlorides, olefins and the phosphate or phosphine oxide.

It was the purpose of this study to gain a more detailed insight into this reaction. The conditions for obtaining maximum yields of the t-alkyl chloride were determined using tetrahydrolinalyl hypochlorite and triphenyl phosphite as reactants. The best yields of t-alkyl chloride

were obtained by adding the phosphite in methylene chloride to the hypochlorite in methylene chloride at -85°. Poorer yields were obtained at higher temperatures. When triphenylphosphine or tri-n-butylphosphine were used lower yields were also obtained.

The reaction of bicyclo-(1,2,2)-1-heptyl hypochlorite with triphenylphosphine, in nonpolar solvents, gave bicyclo-(1,2,2)-1-heptyoxytriphenylphosphonium chloride. When the same reaction was conducted in methanol bicyclo-(1,2,2)-1-heptanol and triphenylphosphine oxide were the products. These results are explainable if the initial attack by the phosphorus compound is on the chlorine atom of the hypochlorite to give an alkoxide ion and a chlorophosphonium ion.



In nonhydroxylic solvents these ions combine via path A to give the salt I. In hydroxylic solvents the alkoxide ion undergoes rapid proton exchange and the products are formed via path B. A control experiment showed that bicyclo-(1,2,2)-1-heptyloxytriphenylphosphonium chloride was stable in methanol, thus I did not decompose in methanol to the products observed.

When optically active tetrahydrolinalyl hypochlorite was allowed to react with triphenyl phosphite, optically active tetrahydrolinalyl chloride was isolated. By solvolyzing the chloride in absolute methanol and relating the configuration of the tetrahydrolinalyl methyl ether obtained to tetrahydrolinalool, it was shown that the tetrahydrolinalyl chloride was of opposite configuration to that of the starting tetrahydrolinalool.

The results of these experiments are consistent with initial formation of an alkoxyphosphonium chloride. Subsequent rapid decomposition via an inversion mechanism gives optically active tetrahydrolinalyl chloride. Competing with this inversion mechanism is an ionization mechanism which leads to racemic chloride and olefin. This reaction becomes dominant as the temperature is increased. It also becomes the major path as the stability of the intermediate phosphonium salt decreases.

Microfilm \$2.75; Xerox \$4.20. 77 pages.

SOME REACTIONS OF N-BROMOSUCCINIMIDE

(Order No. Mic 61-2183)

**Robert S. Franzblau, Ph.D.
Rutgers University, 1961**

Major Professor: Roderick A. Barnes

Several reactions of N-Bromosuccinimide (**I**) were examined. **I** reacts with cyclohexene in ethylene glycol to

yield 2-(2-bromocyclohexoxy) ethanol (II) in 69% yield. Treatment of II with silver acetate produced the corresponding acetate from which the diol was prepared. All attempts to prepare hexahydrobenz-1,4-dioxane from any of the above compounds failed.

Treatment of 3-methyl-3-phenyl-butene-1 (III) with I in aqueous medium yielded only that bromohydrin which would be formed by a rearrangement of the carbon skeleton, i.e., 4-bromo-3-phenyl-2-methyl-butanol-2 (IV) as evidenced by reduction to the alcohol, dehydration and ozonolysis of the resulting olefin.

The reaction of α -pinene with I in methanol was found to be very complex and no pure products could be isolated and characterized, however, both a mono- and a di-methoxy substituted terpene were isolated.

The possibility that I may either react as or pass through an enolic intermediate was examined. The delocalization energies of the succinimide anion and radical were calculated for both the dienol and diketo structures using various values for the carbon-oxygen resonance integral. The calculations show the dienol to be the more stable form for both the anion and radical. Spectral and chemical evidence, including a comparison of the rates of reaction of I and N-Bromo- α , β -diphenylsuccinimide (V) with cyclohexene under free radical conditions, do not support this conclusion.

Attempts to prepare N-Bromo-tetraphenylpyrrole by various methods failed.

Microfilm \$2.75; Xerox \$4.40. 84 pages.

AN APPROACH TO THE SYNTHESIS OF CYCLOHEXADIENONES

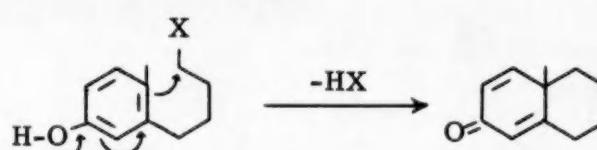
(Order No. Mic 61-1453)

William Evan Hill, Ph.D.
Emory University. 1959

Director: Leon Mandell

In the presence of acidic catalysts, the cyclohexadienone system will undergo a reaction known as the "dienone-phenol rearrangement"; the effects of environment and of structural traits on the course of this reaction have attracted investigation since 1930, when the generality of the rearrangement was first recognized. Of more recent origin is an interest in the dienone system deriving from the antiarthritic activity which it imparts to certain steroids containing it. New synthetic methods for molecules embodying the cyclohexadienone moiety would facilitate preparation of compounds for further study of chemical reactivity and for physiological testing.

This research was undertaken to test a proposal that an intramolecular Reimer-Tiemann reaction might offer a ready route to cyclohexadienone synthesis. The experimental approach was designed to determine the feasibility of the following reaction:



where X is an easily displaceable entity, such as I or OTs. The tosyl group was selected as the most convenient to affix, and most of these experiments were run on 4-(2-methyl-5-hydroxyphenyl)-butyl-p-toluenesulfonate.

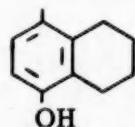
The synthetic sequence to obtain 4-(2-methyl-5-hydroxyphenyl)-butanol, the immediate precursor to the tosylate, began with an alkaline pyrolysis of 2-naphthol-6,8-disulfonic acid, dipotassium salt, to yield 2-methyl-5-hydroxybenzoic acid. Subsequent reactions extended the carboxyl side chain of the latter compound. Esterification of 2-methyl-5-hydroxybenzoic acid, followed by reduction with lithium aluminum hydride, gave 2-methyl-5-methoxybenzyl alcohol which was converted, with thionyl chloride, to 2-methyl-5-methoxybenzyl chloride. Treatment with potassium cyanide and subsequent hydrolysis gave 2-methyl-5-methoxyphenylacetic acid, which was esterified and reduced with lithium aluminum hydride to -(2-methyl-5-methoxyphenyl)-ethanol. This was converted, with phosphorus tribromide, to -(2-methyl-5-methoxyphenyl)-ethyl bromide which was used to alkylate diethyl malonate, yielding, after decarboxylation, 4-(2-methyl-5-methoxyphenyl)-butyric acid. Lithium aluminum hydride reduction to the alcohol, followed by cleavage of the methoxy group with potassium hydroxide in diethylene glycol, gave rise to the desired product, 4-(2-methyl-5-methoxyphenyl)-butanol.

The tosylate, formed by treatment of the substituted butanol with p-toluenesulfonyl chloride, was refluxed in anhydrous t-butyl alcohol in which a slight excess of potassium had been dissolved. The oily cyclization product of this reaction was also obtained, with somewhat less discoloration, by reflux with sodium ethoxide in benzene. Infrared analysis detected no dienone in this product.

The oily cyclization product was a mixture which could be dissolved in hot methanol and cooled to yield a small amount of a solid shown by its infrared absorption spectrum to contain no hydroxyl group. Dissolving the cyclization product in hot petroleum ether, followed by cooling yielded a slightly greater amount of solid whose infrared spectrum exhibited strong phenolic-hydroxyl absorption. A solvolytic separation procedure was developed, supplemented by preliminary extraction with aqueous sodium hydroxide to remove some of the phenolic compound, which showed surprising resistance to base and required repeated extractions.

The nonhydroxylic material was recognized by its chemical behavior and infrared absorption spectrum as an ether, but the micro quantity of this compound restricted investigation and identification was not completed.

The hydroxylic component, separated in far greater quantity, was identified as 4-methyl-ar-1-tetralol. It arose from cyclization at a position ortho to the phenolic



hydroxyl group of the tosylate, followed by aromatization of the transient dienone intermediate. Since none of the stable dienone which would have resulted from cyclization at the para position was found, it appears that any design for a dienone synthesis based on the abnormal Reimer-Tiemann reaction must recognize and cope with the strong preference for ortho condensation.

Microfilm \$2.75; Xerox \$4.00. 71 pages.

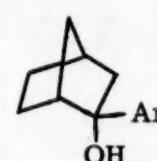
INVESTIGATIONS OF SOME ARYL NORBORNYL DERIVATIVES AND THEIR RESPECTIVE CARBONIUM IONS

(Order No. Mic 61-1992)

Donald Clifford Kleinfelter, Ph.D.
Princeton University, 1960

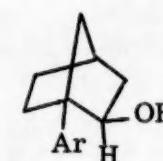
Part I: For the purpose of investigating the non-classical bridged ion in the bicyclo (2.2.1) heptane system a number of aryl norbornanols were prepared and their ultraviolet and visible absorption spectra in concentrated sulfuric acid were studied.

Addition of aryl magnesium or lithium reagents to norbornanone gave 2-aryl-2-endo-norbornanols (I). These alcohols underwent a Wagner-Meerwein rearrangement in acetic acid catalyzed by 50% sulfuric acid to give 1-aryl-2-exo-norbornyl acetates. Nitration of 1-phenyl-2-exo-norbornyl acetate produced the para-nitrophenyl derivative, from which the amino and dimethylamino compounds were obtained. Saponification to the exo-alcohols (II) followed by oxidation afforded 1-aryl-2-norbornanones. These were reduced by LiAlH₄ or NaBH₄ to the epimeric endo-alcohols (III) and were reacted with an aryl lithium reagent to the desired 1-aryl-2-aryl-2-endo-norbornanols (IV).



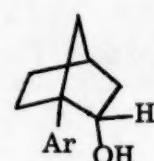
(I)

Ar=Ø, p-CH₃Ø, p-ClØ,
O-OCH₃Ø, m-OCH₃Ø, p-OCH₃Ø,
p-NMe₂Ø



(II)

Ar=Ø, p-CH₃Ø, p-ClØ,
O-OCH₃Ø, m-OCH₃Ø,
p-OCH₃Ø,
p-NO₂Ø, p-NH₂Ø, p-NMe₂Ø



(III)

Table of Ultraviolet and Visible Spectra

<u>Ar</u>	<u>Ar'</u>	λ max	λ max*
Ø	Ø	274	379
Ø	<u>p</u> -CH ₃ Ø	366, 375	381, 398 ^{Sh}
<u>p</u> -CH ₃ Ø	Ø	366, 375	380, 398 ^{Sh}
<u>p</u> -CH ₃ Ø	<u>p</u> -CH ₃ Ø	388, 397	399, 393 ^{Sh}
Ø	<u>p</u> -ClØ	275.5, 283	385, 398
<u>p</u> -ClØ	<u>p</u> -ClØ	400	402
Ø	<u>p</u> -NMe ₂ Ø	365	366
<u>p</u> NMe ₂ Ø	<u>p</u> -NMe ₂ Ø	365	366
<u>p</u> -OCH ₃ Ø	<u>p</u> -OCH ₃ Ø	326, 345 ^{Sh}	345, 330 ^{Sh}

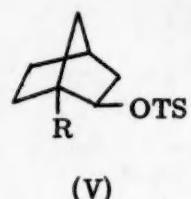
*The alcohols were initially dissolved in the minimum amount of acetic acid.

In sulfuric acid solution all the identically substituted monoaryl norbornanols, I-III, exhibited their absorption maxima at the same position, ranging from 310 m μ , log ϵ = 3.97 for para-nitrophenyl to 318 m μ , log ϵ = 3.97 for para-anisyl. All extinction coefficients are considerably smaller for the diaryl carbonium ions when compared with the mono-aryl analogs. This reduced intensity is

interpreted on steric grounds. The absorption spectra are discussed in detail; it is implied that bridged ions are forming in the diaryl cases.

Part II: The acetolysis of the tosylate derivatives of the 1-aryl-2-norbornanols (see tables below) were carried out to determine what effect a 1-aryl substituent would exert on the solvolysis rate.

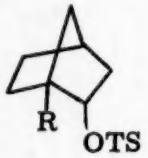
Relative Acetolysis Rates for Exo Compounds, 25°C



R = H	1.0	R = p-MeO \emptyset	7.7
Me	51.	p-Me \emptyset	6.5
Et	78.	\emptyset	3.9
		m-MeO \emptyset	4.0
		p-Cl \emptyset	1.6
		p-NO ₂ \emptyset	0.32

Constants	rho	r	s	<u>o</u> -OCH ₃ \emptyset
σ	-1.36	0.985	0.100	
$\sigma +$	-0.95	0.931	0.210	

Relative Acetolysis Rates for Endo Compounds, 75°C



R = H	1.0	R = p-MeO \emptyset	0.69
Me	1.17	p-Me \emptyset	0.59
Et	1.53	\emptyset	0.56
		m-MeO \emptyset	0.54
		p-Cl \emptyset	0.21
		p-NO ₂ \emptyset	0.066

Constants	rho	r	s	<u>o</u> -OCH ₃ \emptyset
σ	-1.01	0.953	0.134	
$\sigma +$	-0.69	0.873	0.216	

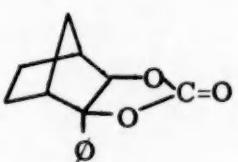
The rate data for the aryl compounds was correlated with the Hammett Equation. More exact agreement was obtained using ordinary sigma rather than sigma + substituent constants. The rate order Et > Me >> \emptyset > H for the exo-compounds is explained by the hypothesis that the transition state is closer to the starting material than to the intermediate bridged ion. The 1-aryl-2-endo-norbornyl tosylate acetolyzed more slowly than endo-norbornyl tosylate since participation is absent in this series.

The fast rates exhibited by the ortho-anisyl compounds are explained on the basis of anchimerically assisted solvolyses via oxygen participation.

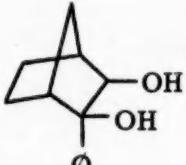
In addition to these studies 2 phenyl norbornene (VII) was reacted with excess performic acid to give a carbonate (VIII) of 2-endo-phenyl norbornane-2,3-cis diol (IX), a preparation unique in organic chemistry.



(VII)



(VIII)



(IX)

Microfilm \$4.55; Xerox \$16.20. 356 pages.

A KINETIC STUDY OF SOME
ETHYL-SUBSTITUTED ACETOPHENONE OXIMES
IN THE BECKMANN REARRANGEMENT

(Order No. Mic 61-2318)

Patrick John McNulty, Ph.D.
Vanderbilt University, 1961

Supervisor: Dr. D. E. Pearson

Several rather unusual observations were made in comparing rates of rearrangement of alkyl-substituted acetophenone oximes. The most remarkable observation was that p-alkyl substituents show less electron-release ability (relative to hydrogen) than they do in nucleophilic reactions, a fact hardly compatible with present-day theory of alkyl group behavior. The second observation was that δ -constants of alkyl groups occupying positions ortho to each other were not additive in predicting rate. A third observation was that the rate of rearrangement of propiophenone oxime was much faster than anticipated, suggesting a considerable influence of the non-migrating group on the rate. A fourth observation was that the log rate of rearrangement of acetophenone oxime was correlative with H_o (slope = -0.72). These observations were made possible by the development of a new spectrophotometric method of analysis of ketone concentration.

The results with substituted oximes are as follows:

Oxime	Temp., °C	k x 10 ³ min. ⁻¹	Half-life min.	ΔE	ΔS
Propiophenone	31.30	0.897	775	25.3	+0.5
oxime	41.23	3.37	205		
	50.77	11.30	60		
Acetophenone	41.23	0.386	1795	26.0	-1.6
oxime	50.77	1.36	510		
	51.37	1.47	470		
	61.30	4.75	145		
3-Methyl	41.23	0.542	1280	25.4	-2.6
	50.77	1.92	360		
	61.30	6.31	110		
3-Ethyl-	41.23	0.601	1155	25.4	-2.8
	51.37	2.14	324(326)		
	61.30	6.98	100		
4-Ethyl-	41.23	0.682	1015	26.3	+0.4
	51.37	2.60	264(270)		
	61.30	8.67	80		
3,5-Diethyl	41.23	0.837	830	26.0	-0.2
	51.37	3.08	226(224)		
	61.30	10.27	70		
3,4-Diethyl	41.23	0.858	810	26.1	-0.02
	51.37	2.96	235(233)		
	61.30	10.65	65		
3,4,5-Triethyl	51.37	4.10	170	24.3	-4.8
	61.80	13.26	50		

The items following each abstract are: the price of a microfilm copy; the price of a copy enlarged by the Xerox process to 6 x 8½ inches; the number of pages in the manuscript. Please order copies by number.

*This work has been published in J. Am. Chem. Soc.,
81, 612 (1959).
Microfilm \$2.75; Xerox \$8.00. 173 pages.

SOME INTRAMOLECULAR REARRANGEMENTS AT ULTRA HIGH PRESSURES

(Order No. Mic 61-1085)

Michael Irving Naiman, Ph.D.
Columbia University, 1961

The rates of rearrangement of allyl phenyl ether and ethyl (1-ethylpropenyl) allylcyanacetate were studied at pressures up to 7000 kgs/cm² in solvents of varying polarities. In all, the rate is accelerated by pressure and in most cases the calculated values of ΔV^\ddagger vary from -6 to -8 cm³ per mole. The absence of a substantial solvent effect on the rate of reaction and the constancy of ΔV^\ddagger in solvents of varying compressibilities eliminate any large polar effect in the transition state and supports the Hurd-Pollack mechanism for the above rearrangements. The value of -6 to -8 cm³ per mole for ΔV^\ddagger agrees well with what one would expect of a cyclic transition state made up of a quasi six-membered ring.

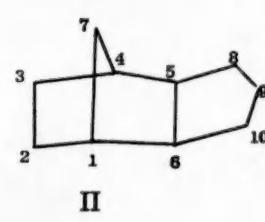
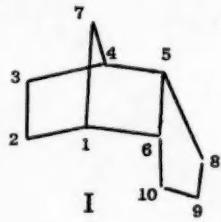
Microfilm \$2.75; Xerox \$4.40. 83 pages.

ADAMANTANE: FORMATION AND REACTIONS.

(Order No. Mic 61-1998)

Robert David Nicholas, Ph.D.
Princeton University, 1960

The mechanism of formation of adamantane from endo- and exo- trimethylene norbornane has been investigated using the method of methyl labeling. In the endo- (I) and exo- (II) series, the following methyl compounds were prepared.



8- endo, 9- endo,
7-

2- endo, 8- exo,
9- exo

The compounds were rearranged to methyl adamantane using either aluminum chloride or bromide. The results of these isomerizations (Table I) are discussed in terms of a proposed mechanism.

Other ring systems have been investigated to determine if rearrangement to an adamantane product will take place. (Table II).

Table I
Composition of Methyl Adamantane Product from Isomerization of Methyl Trimethylene- norbornanes.

Starting Material	React. Temp.	% Methyl Adamantane	
		1-	2-
<u>exo</u> - trimethylene -2- <u>endo</u> - methyl norbornane	Room	99.7	0.3
<u>exo</u> - trimethylene -8- <u>exo</u> - methyl norbornane	Room	92.3	7.7
<u>exo</u> - trimethylene -9- <u>exo</u> - methyl norbornane	Room	87.3	12.7
<u>endo</u> - trimethylene -7- methyl norbornane	Reflux	98.6	1.4
<u>endo</u> - trimethylene -9- <u>endo</u> - methyl norbornane	Room	84.5	15.5
<u>endo</u> - trimethylene -8- <u>endo</u> - methyl norbornane	Reflux	main	?

Table II
Summary of Results on the Rearrangement of Various Ring Systems to Adamantane and its Derivatives.

Starting Material	Yield of Adamantane Product
Camphene	0% adamantane
$\Delta^{9:10}$ and $\Delta^{1:9}$ octalin	0% adamantane
<u>exo</u> - tetramethylene- norbornane	100% 1- methyl adamantane
9- <u>exo</u> - methyl- tetra- methylene norbornane	74.5% 1, 3- dimethyl adamantane
tetrahydro-dicyclo- hexadiene	45.7% 1, 3- dimethyl adamantane
dimethyl- tetrahydro- dicyclopentadiene	23.3% 1, 3- dimethyl adamantane

These results are discussed in terms of the proposed reaction mechanism.

Monsubstituted secondary derivatives of adamantane have been prepared for the first time via the free radical hydroxylation of adamantane. The compounds prepared are shown below.



x, y = O x = H, y = OH; x = CH₃; y = OH
x, y = CH₂; x = H, y + CH ; x = CH₃; y = O C H
x = H, Y = O T S.

The availability of primary and secondary derivatives of adamantane prompted an investigation of the infra-red and

nuclear magnetic resonance spectra of these compounds. The influence of the rigidity of the adamantane structure is clearly evident in these studies, particularly in comparison of adamantane derivatives with similarly substituted compounds, as with adamantanone and other cyclic ketones.

pKa values have been determined for adamantane 1-carboxylic acid and other bridgehead acids. It is suggested that the low acidity of these acids is caused by steric hindrance to solvation of the carboxylate anion.

Reaction of adamantane with chromic acid has been found to give high yields of 1-adamantanol, in addition to some adamantanone. The chromic acid oxidations of *cis*- and *trans*- decalin, norbornane, and bicyclo (2.2.2.) octane have also been studied. The results of these investigations, along with those of other workers, are interpreted as evidence for an oxygen insertion reaction in the chromic acid oxidation of hydrocarbons.

Solvolytic studies on 1- and 2- adamantane derivatives have been carried out. The relative rates of bridgehead derivatives (Table III) are interpreted in terms of solvation factors and angle strain.

Table III
Relative Rates of Solvolysis
of Bridgehead Derivatives, 25°C.

t-Bu x	1- Ad. x	1- bicyclo (2.2.2) octane- x	1- norbornyl-
1.0	10^{-3}	10^{-6}	10^{-14}

The acetolysis of 2- adamantyl tosylate has shown that the importance of an increase in strain energy in passing from a tetrahedral ground state to a quasi-trigonal transition state is of primary importance in determining rates of reaction (Table IV).

Table IV
Relative Rates of Acetolysis of Tosylates
on a Methylene Bridge, 25°C.

cyclohexyl	2- adamanyl	7- norbornyl
1.0	0.067	1.3×10^{-7}

Microfilm \$4.15; Xerox \$14.65. 323 pages.

SYNTHETIC APPROACHES TO THE CYCLIC ETHYLENE KETAL OF CYCLOPENTADIENONE

(Order No. Mic 61-2268)

Billy Wayne Ponder, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Charles H. DePuy

Several reactions of dicyclopentadienone have been investigated. The dimer may be reduced easily to the saturated diketone with palladium on charcoal catalyst. The bridged carbonyl group in the dimer is very reactive and may be reduced to the alcohol without affecting the

α, β -unsaturated ketone group. An interesting rearrangement of this system was studied. It appears that rearrangement of 1-hydroxy-8-keto-4,7-methano-3a,4,7,7a-tetrahydroindene to the more stable 1-keto-8-hydroxy system has been observed, and the evidence is discussed.

Three synthetic routes to the cyclic ethylene ketal of cyclopentadienone have been investigated. The first method involved the pyrolysis of 1-hydroxy-8(cyclic ethylene ketal)-4-,7-methano-3a,4,7,7a-tetrahydroindene in an attempt to "crack" the molecule to give the desired diene ketal. The reverse Diels-Alder reaction appears to have occurred, as evidenced by the isolation of some cyclopentenone, but the high temperatures involved in the pyrolysis procedure probably accounts for the destruction of the diene ketal as it was formed.

The second approach was along a more conventional route than the previous one. Cyclopentanone was chlorinated, the chloroketone was converted to its cyclic ethylene ketal derivative, and then dehydrohalogenation gave cyclopent-2-enone ketal. The crucial step in this synthetic route was the conversion of this ketal to the new compounds, 4-bromocyclopent-2-enone cyclic ethylene ketal and the corresponding 4-(N,N-dimethylamino) derivative. The bromo compound is too unstable to be isolated and consequently the N,N-dimethylamino compound must be generated "in situ" by the addition of anhydrous dimethylamine. Conversion of this tertiary amine to the N-oxide with subsequent pyrolysis gave a mixture of products, one of which was the dimer of cyclopentadienone ketal.

The third synthetic approach was designed to eliminate the side reaction products which accompanied the amine oxide pyrolyses. The quaternary ammonium hydroxide was prepared and pyrolyzed in a manner similar to the amine oxide pyrolysis. This yielded a product which was surprisingly pure, but which, once again, proved to be the dimer of the desired diene ketal. The cyclic ethylene ketal of cyclopentadienone is considerably less stable than originally anticipated and seems to dimerize quite rapidly, even at low temperatures. Perhaps it should more correctly be compared to cyclopentadienone in this respect.

Microfilm \$2.75; Xerox \$3.60. 62 pages.

THE SYNTHESIS OF SOME DERIVATIVES OF PURINE AND PYRIMIDINE OF POTENTIAL ANTI-TUMOR ACTIVITY

(Order No. Mic 61-1511)

Sameeh Saïd Toukan, Ph.D.
Temple University, 1961

One pyrimidine and a number of 6-substituted purine derivatives were prepared as possible anti-tumor agents.

2-Ethylmercapto-4-methyl-6-(1-pyrrolyl)pyrimidine and 6-(1-pyrrolyl)purine were prepared by condensation of potassium pyrrole with the corresponding chloro derivatives. Subsequent treatment of the pyrimidine product with picric acid gave the picrate salt.

The reaction of 6-(2-hydroxyethylamino)purine, 6-[bis(2-hydroxyethyl)amino]purine and 6-[4-(2-hydroxyethyl)-1-piperazinyl]purine with thionyl chloride gave the corresponding chloro derivatives.

The reaction of 6-[bis-(2-hydroxyethyl)amino]purine

with thionyl chloride in pyridine in the cold gave the sulfoxide, N-(6-purinyl)-1-oxothia-2,8-dioxa-5-azacyclooctane.

The dehydrohalogenation of 6-(2-chloroethylamino)purine with ethanolic sodium hydroxide gave 6-(1-aziridinyl)purine.

When pyrrolidine, piperidine, thiamorpholine, piperazine, 1-benzylpiperazine and 1-(2-hydroxyethyl)piperazine were allowed to react with 6-chloropurine, the following derivatives were obtained: 6-(1-pyrrolidinyl)purine, 6-N-piperidinopurine, 6-N-thiamorpholinopurine, 6-N-piperazinylpurine, 6-(4-benzyl-1-piperazinyl)purine and 6-[4-(2-hydroxyethyl)-1-piperazinyl]purine.

6-N-piperazinylpurine was also prepared by the reductive debenzylation of 6-(4-benzyl-1-piperazinyl)purine.

The hydrochloride salts of N-(6-purinyl)glycine and β -(6-purinylamino)alanine were obtained when ethyl chloroacetate and the methyl ester of 2-amino-3-chloropropionic acid hydrochloride were allowed to react with adenine and subsequent saponification of the product followed by acidification with HCl.

N-(6-purinyl)serine was prepared by the reaction of 6-chloropurine with serine in the presence of ethanolic sodium hydroxide and subsequent acidification of the product with acetic acid.

When 2-aminothiazoline, 2-aminothiazole and 3-amino-1,2,4-triazole were allowed to react with 6-chloropurine, only 6-(2-thiazolinylamino)purine was formed while the other two amino derivatives failed to react.

Microfilm \$2.75; Xerox \$4.40. 82 pages.

**IDENTIFICATION AND CHARACTERIZATION
OF ORGANIC NITROGEN, ORGANIC PHOSPHORUS,
AND FLUORESCENT COMPOUNDS
IN ELECTROPHORETIC SEPARATES
OF SOIL ORGANIC MATTER.**

(Order No. Mic 61-2853)

Acie Chandler Waldron, Ph.D.
The Ohio State University, 1961

Organic nitrogen, organic phosphorus, and fluorescent compounds were identified and characterized in electrophoretically fractionated samples of organic matter extracted from a Brookston silty clay loam.

Fifty ninhydrin positive compounds were detected by means of paper chromatography in the separates of HCl extracts. Twenty-five of these were identified as amino acids or amino sugars. Fifty-three ninhydrin positive compounds were detected in the separates of NaOH extracts. Twenty-four of these were identified as amino acids or amino sugars. Sixteen ninhydrin positive compounds were detected in $\text{Na}_4\text{P}_2\text{O}_7$ extract, and eight of these were identified as amino acids. The compounds extracted by HCl and NaOH appeared to be essentially the same, although HCl was more drastic in its extraction.

Diphenylcarbazone positive compounds, which were indicative of the possible presence of nucleic acid, and inositol phosphorus compounds were found in all of the organic matter extracts. A positive identification of the compounds constituting these fractions was not possible. The presence of diphenylcarbazone positive compounds and inositol phosphates in the extracts was not considered

as fully representative of soil organic matter. The methods of hydrolysis used in this study were too drastic to allow for reliable characterization of nucleic acids and organic phosphates in the soil.

The distribution of nitrogen-containing compounds identified in the separates indicated that continuous flow paper electrophoresis of organic matter extracts was fairly satisfactory in separating various components of the complex mixture. However, the systems used in this study did not limit the collection of individual compounds to a narrow distribution range and did not prevent the overlapping of several compounds in the same general collection area. The identification of individual compounds within a component was greatly facilitated through electrophoretic fractionation.

A comparison of the electrophoretic mobilities, the color of extracts, and the identification of compounds in the NaOH and $\text{Na}_4\text{P}_2\text{O}_7$ extracts indicated that $\text{Na}_4\text{P}_2\text{O}_7$ probably extracted only the humic acid fraction from organic matter. The majority of the organic nitrogen in $\text{Na}_4\text{P}_2\text{O}_7$ extract was associated with the brown colored fraction and was not identified. Further hydrolysis would be necessary before the compounds in this fraction can be identified.

The fluorescent characteristics of organic matter extracts were studied with the Aminco Bowman Spectro-photofluorometer, paper strip electrophoresis, and infrared analysis. Part of the fluorescence in the extracts was found to be due to the presence of chlorophyll derivatives. The infrared spectra, however, showed that hydrolysis of chlorophyll completely altered the molecule from its natural state. After the chlorophyll pigment had been removed from the soil with acetone, the hydrolyzed soil extracts still showed fluorescent properties. This phenomenon indicated that other fluorescent compounds were evidently present in soil organic matter. These compounds were not positively identified.

Electrophoretic studies showed that fluorescent compounds were apparently adsorbed on the brown colored humic material. In an isolated state the fluorescent fraction exhibited no electrophoretic mobility, but when associated with the brown colored material it appeared to move immediately in front of and with the brown material.

The infrared spectra of the fluorescent fraction showed that this material was a very complex substance. Both aliphatic and aromatic structures were found to be important components of the fluorescent fraction. Functional groups and aliphatic components were monosubstituted on the aromatic structure.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

**MECHANISM OF AROMATIC SUBSTITUTION
BY FREE RADICALS**

(Order No. Mic 61-2277)

James Harvey Waters, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: George S. Hammond

The decomposition of benzoyl peroxide in toluene has been studied. The yields of some of the products have been

determined as a function of the initial concentration of the peroxide over a three hundred-fold range. The yields of bibenzyl and o-methylbiphenyl, and the sum of the yields of m- and p-methylbiphenyls, have been determined by quantitative gas chromatographic analysis. Reaction mixtures were worked up in the presence of air, which oxidizes dihydrobiphenyls to biphenyls. The yields of bibenzyl observed are considerably higher than those reported in the literature, and increase markedly as the concentration of benzoyl peroxide is reduced. The yields of the methylbiphenyls also appear to increase slightly as the concentration of peroxide is decreased.

The variation in the yield of o-methylbiphenyl initially formed in the reaction was determined as a function of the concentration of benzoyl peroxide by isotope dilution analysis. The product mixtures were treated with trifluoro-peracetic acid to destroy the corresponding dihydromethylbiphenyls. The yields were found to be much lower than those determined in runs worked up in the presence of air, and to decrease as the initial concentration of benzoyl peroxide is diminished.

Table 1. Average yields of products determined by gas chromatography, in moles per mole of peroxide

concentration of peroxide, m./l.	o- isomer	m- and p- isomers	bibenzyl
0.310	0.272	0.212	0.242
0.0972	.306	.228	.256
0.0312	.280	.228	.328
0.00929	.308	.228	.350
0.00308	.332	.280	.380
0.00102	.332	.282	.464

Table 2. Yields of initially formed o-methylbiphenyl by isotope dilution analysis

concentration of peroxide, m./l.	yield, moles/mole	concentration of peroxide, m./l.	yield, moles/mole
0.100	0.151	0.0102	0.112
.0314	.112	.00302	.104
.0312	.146	.00101	.095
.302	.145		

A reaction scheme is considered which involves competing irreversible attack of radicals on the nucleus and on the methyl group of toluene. The variations in yields are ascribed to changes in the nature of the predominant radical species at different concentrations. The scheme is shown to account for the observed yield data. An alternative scheme, in which slow reversal of the addition of the nucleus occurs, cannot be ruled out.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

THE CONSTITUTION OF STREPTOLIN

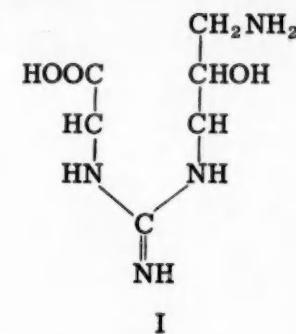
(Order No. 61-2986)

Howard Arnold Whaley, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Eugene E. van Tamelen

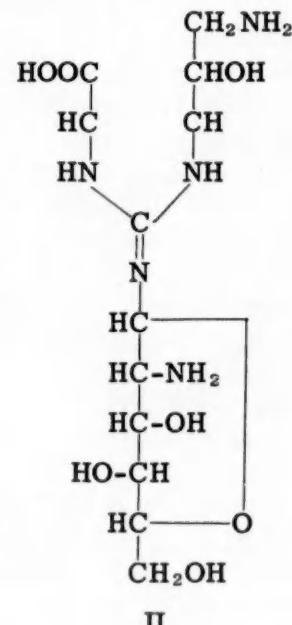
The structure of two hydrolysis fragments of the antibiotic, streptolin, have been studied. Streptolin has been purified and its structure investigated.

Streptolidine, a 2-iminoimidazoline amino acid isolated from streptolin hydrolysates, has been converted to the mono-N-benzenesulfonate, which was then reductively deaminated. This reaction gave a product containing a C-methyl group that was not present in the starting material. This finding limits the possible structures of streptolidine to those incorporating a terminal amino group on the aminoalcohol side chain, and when combined with previous evidence, indicates structure I for streptolidine.

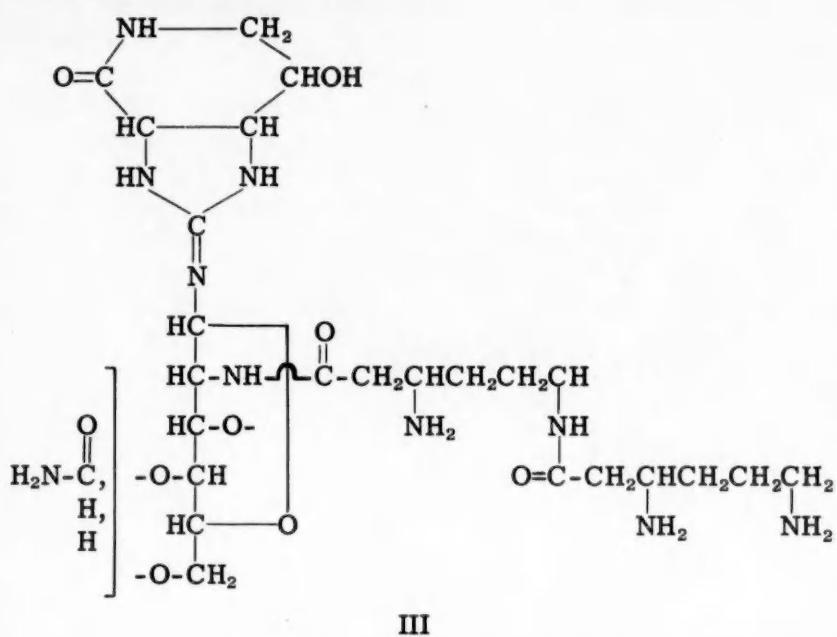


Compound 5, an acid hydrolysis fragment of streptolin containing streptolidine linked to 2-amino-2-desoxyglucose by an N-glycoside bond, was converted to an N,N'-diacetyl derivative. van Slyke amino nitrogen determinations on this compound over extended periods of time were characterized by a very slow evolution of nitrogen, while model

compounds containing an $\text{NH}_2-\text{C}(\text{N}-\text{N}-)\text{NH}$ unit evolved nitrogen more rapidly. On this basis, the aminosugar portion of compound 5 was tentatively placed on the exocyclic nitrogen of the 2-iminoimidazolidine group in compound 5, as shown in structure II.



Streptolin was purified by cellulose column chromatography. The products of partial degradation under mildly acidic and mildly alkaline conditions, were studied. The behavior of the function that yields ammonia and carbon dioxide on hydrolysis compared favorably with that of the O-carbamyl group known to be present in novobiocin. A streptolin structure (III) is proposed on the basis of these and previous findings.



Microfilm \$2.75; Xerox \$6.20. 130 pages.

CHEMISTRY, PHARMACEUTICAL

DERIVATIVES OF PYRIDO[2,3-d]PYRIDAZINE.

(Order No. Mic 61-2730)

Eugene Walter Alpern, Ph.D.
University of Michigan, 1961

A series of 6,7-dihydropyrido[2,3-d]pyridazine-5,8-diones substituted in the 6, 7 or 6,7 positions were prepared by the reaction of quinolinic anhydride (I) with the following hydrazines: hydrazine, N,N'-dimethylhydrazine, N,N'-dibenzylhydrazine, methylhydrazine, phenylhydrazine, benzylhydrazine and N-benzyl-N'-phenylhydrazine. The condensation products obtained from these reactions were 6,7-dihydropyrido[2,3-d]pyridazine-5,8-dione (II), 6,7-dihydro-6,7-dimethylpyrido[2,3-d]pyridazine-5,8-dione (III), 6,7-dibenzyl-6,7-dihydropyrido[2,3-d]pyridazine-5,8-dione and, presumably, 6,7-dihydro-7-methylpyrido[2,3-d]pyridazine-5,8-dione (IV) instead of the corresponding 6-methyl derivative, 6,7-dihydro-6-phenylpyrido[2,3-d]pyridazine-5,8-dione (V) instead of the corresponding 7-phenyl derivative, 7-benzyl-6,7-dihydro-pyrido[2,3-d]pyridazine-5,8-dione instead of the corresponding 6-benzyl derivative, and 7-benzyl-6,7-dihydro-6-phenylpyrido[2,3-d]pyridazine-5,8-dione instead of the corresponding 6-benzyl-7-phenyl derivative.

5-Acetoxy-7-acetylpyrido[2,3-d]pyridazin-8(7H)-one (VI) was prepared from the reaction of II with acetic an-

hydride. Under very mild hydrolytic conditions, VI lost one acetyl group with the formation of a product which was believed to be the N-acetyl derivative, 7-acetyl-6,7-dihydropyrido[2,3-d]pyridazine-5,8-dione (VII). The only other N-acetyl derivative which could be formed would have been 6-acetyl-6,7-dihydropyrido[2,3-d]pyridazine-5,8-dione (VIII). Compound VIII was synthesized by reaction of I with acetylhydrazine to form N-acetyl-N'-(3-carboxypicolinoyl)hydrazine and subsequent cyclization of this product. The structure of VII was deduced from the fact that it was shown to be different from VIII by a mixed melting point determination.

Compound I reacted with formylhydrazine to give N-formyl-N'-(3-carboxypicolinoyl)hydrazine (IX); cyclization of IX formed 6,7-dihydro-6-formylpyrido[2,3-d]pyridazine-5,8-dione. Reaction of acetic anhydride with IV yielded 5-acetoxy-7-methylpyrido[2,3-d]pyridazin-8(7H)-one and with V formed 8-acetoxy-6-phenylpyrido[2,3-d]pyridazin-5(6H)-one.

Diazomethane reacted with IV to give 5-methoxy-7-methylpyrido[2,3-d]pyridazin-8(7H)-one and with V to form 8-methoxy-6-phenylpyrido[2,3-d]pyridazin-5(6H)-one, isolated as the hydrochloride.

From the interaction of II and phosphorus oxychloride a product was obtained which, as indicated by analytical data, may be either 5-chloropyrido[2,3-d]pyridazin-8(7H)-one or 8-chloropyrido[2,3-d]pyridazin-5(6H)-one. From the reaction of II and phosphorus oxychloride, under slightly different conditions, the product obtained was 5,8-dichloropyrido[2,3-d]pyridazine. Reaction of IV with phosphorus oxychloride gave 5-chloro-7-methylpyrido[2,3-d]pyridazin-8(7H)-one (X).

Catalytic hydrogenation of II, III and IV gave the corresponding 1,2,3,4-tetrahydro compounds. When X was hydrogenated, 7-methyl-1,2,3,4-tetrahydropyrido[2,3-d]pyridazin-8(7H)-one was obtained.

Reduction of IV with lithium aluminum hydride gave an oil which, when treated with benzoyl chloride, formed a product which was, presumably 6-benzoyl-7-methyl-5,6,7,8-tetrahydropyrido[2,3-d]pyridazine.

Compound I reacted with benzylamine to yield 2-(N-benzylcarbamoyl)nicotinic acid. The reaction of I with methylamine gave 2-(N-methylcarbamoyl)nicotinic acid, which was cyclized to N-methylquinolinimide by the use of thionyl chloride or acetic anhydride.

An attempt was made to synthesize 3-formylpicolinic acid which was desired for a structure proof of the pyrido[2,3-d]pyridazines. Ethyl 2-methylnicotinate (XI) was obtained from the reaction of ethyl β -aminocrotonate with propargyl aldehyde. Compound XI was reduced with lithium aluminum hydride to 3-hydroxymethyl-2-methylpyridine, which was oxidized by lead tetraacetate to 2-methylnicotinaldehyde (XII) in 62.5% yield. The acetal of XII was prepared by the use of ethylene glycol. This acetal was oxidized with basic permanganate with the result that 2-methylnicotinic acid was obtained, instead of the acetal of 3-formylpicolinic acid which could have been hydrolyzed to the desired 3-formylpicolinic acid.

Microfilm \$2.75; Xerox \$4.80. 92 pages.

**THE USE OF CERTAIN KETONIC COMPOUNDS
IN THE MANNICH REACTION**

(Order No. Mic 61-2762)

Loyd George Kasbo, Ph.D.
University of Michigan, 1961

Certain diketones, amino ketones, hydroxy ketones, esters of β -keto acids and a β -keto acid were allowed to react with paraformaldehyde or formalin and the salt or base of a secondary amine. When ketonic compounds which contain two or more "active hydrogen" atoms were employed, it was not possible, in all cases, to isolate Mannich bases which contained more than one aminomethyl group.

The ketonic compounds employed were acetonedicarboxylic acid (1), ethyl acetoacetate (2), benzoin (3), 4-hydroxy-4-methyl-2-pentanone (4), 5-diethylamino-2-pentanone (5), 4-pyridone (6), 1-methyl-4-piperidone (7), 4-ethylenedioxycyclohexanone (8), 4-hydroxycyclohexanone (9), 2,3-butanedione (10), 2,4-pentanedione (11), 1,4-cyclohexanedione (12), 5,5-dimethyl-1,3-cyclohexanedione (13), and 2,5-dicarbethoxy-1,4-cyclohexanedione (14).

The amines or amine salts used were dimethylamine, dimethylamine hydrochloride and morpholine hydrochloride.

The names of the Mannich bases obtained are listed below. The ketonic compound and the product obtained from it have been assigned the same number but the letter "P" has been added to the number which designates the product.

1,5-Bis(dimethylamino)-3-pantanone di(hydrogen oxalate) (1P).

Dimethylaminomethylbenzoin hydrochloride (3P).

3-Morpholinomethyl-4-hydroxy-4-methyl-2-pentanone hydrochloride (4P).

3-Dimethylaminomethyl-5-diethylamino-2-pentanone dihydrochloride (5P).

1-Dimethylaminomethyl-4-pyridone dihydrochloride (6P).

3-Dimethylaminomethyl-1-methyl-4-piperidone picrate (7P).

3,5-Bis(dimethylaminomethyl)-1-methyl-4-piperidone (7P').

2,6-Bis(dimethylaminomethyl)-4-ethylenedioxycyclohexanone (8P).

2,6-Bis(dimethylaminomethyl)-4-hydroxycyclohexanone (9P).

1,6-Bis(dimethylamino)-3,4-hexanedione di(hydrogen oxalate) (10P).

3-Dimethylaminomethyl-2,4-pentanedione hydrochloride (11P).

2,5-Bis(dimethylaminomethyl)-1,4-cyclohexanedione dihydrochloride (12P).

2,5-Bis(morpholinomethyl)-1,4-cyclohexanedione dihydrochloride (12P').

The basic ketones 7P' and 9P could not be isolated in pure form; however, pure corresponding secondary alcohols were obtained.

Dimethyl acetonedicarboxylate (15) reacted with acetaldehyde and methylamine hydrochloride to form 1,2,6-trimethyl-3,5-dicarbomethoxy-4-piperidone hydrochloride (15P).

Certain products (3P and 7P) could only possess the structures assigned to them. The structures of other products (1P, 6P, 7P' and 15P) were based on the structures of known Mannich bases which had been obtained by analogous reactions. The structures of products 4P, 5P, 8P, 9P, 10P, 11P, 12P and 12P' were determined by various procedures.

The products obtained from the ketonic compounds 2 and 14 were ethyl 2,2,4(or 2,4,4)-tris(dimethylamino-methyl)acetoacetate and 2(or 3)-morpholinomethyl-2,5-dicarbethoxy-1,4-cyclohexanedione hydrochloride, respectively. The former, when treated with hydrochloric acid, yielded bis(dimethylaminomethyl)acetic acid dihydrochloride.

Based on analytical data, the product obtained from compound 13 was a hexasubstituted Mannich base, namely hexa-(dimethylaminomethyl)-5,5-dimethyl-1,3-cyclohexanedione hexahydrochloride. As far as we are aware, no product of this type has been obtained hitherto from a Mannich reaction.

Nine of the Mannich bases, 5P, 6P, 7P, 7P', 8P, 9P, 12P, 12P' and 15P, were reduced to the corresponding secondary alcohols with platinum dioxide in methanol solution. From the reduction of 7P', two stereoisomers were obtained.

A benzilate ester was prepared from the secondary alcohol obtained from 7P and from one of the secondary alcohols obtained from 7P'.

Microfilm \$2.75; Xerox \$4.60. 88 pages.

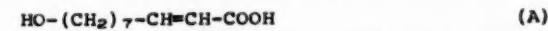
**SYNTHETIC APPROACHES TO
ROYAL JELLY ACID AND ANALOGS**

(Order No. 61-2971)

James Francis Muren, Ph.D.
The University of Wisconsin, 1961

Supervisor: Associate Professor Edward E. Smissman

Interest in the growth-inhibiting properties of royal jelly, a food produced by the common honey bee, was stimulated by the isolation of an active constituent, *trans*-10-hydroxy-2-deenoic acid (A). Cognizance of the antibiotic and tumor-inhibiting properties of this simple ali-

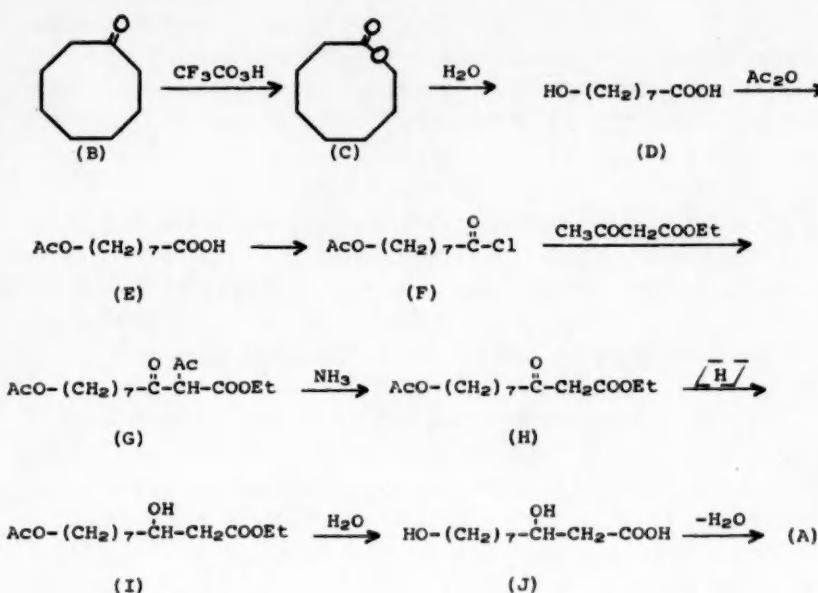


phatic acid encouraged a study of possible synthetic pathways in order to prepare analogs for further study of these interesting properties.

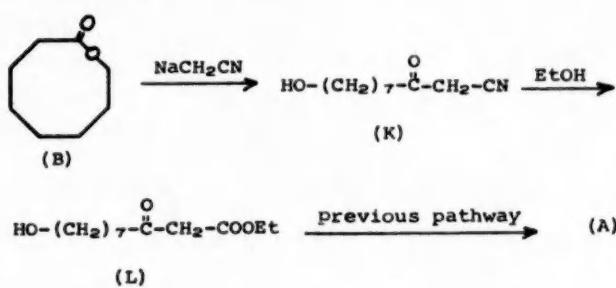
Two syntheses were developed which appear sufficiently versatile to allow ready realization of a wide variety of structural analogs.

Oxidation of cyclooctanone (B) with peroxytrifluoroacetic acid produced ω -octanolactone (C). The lactone was successively hydrolyzed to 8-hydroxyoctanoic acid (D), and acetylated to form 8-acetoxyoctanoic acid (E). Acylation of ethyl acetoacetate with 8-acetoxyoctanoyl chloride (F) yielded ethyl 2-acetyl-3-keto-10-acetoxy-decanoate (G), which, upon ammonolysis, cleaved to ethyl

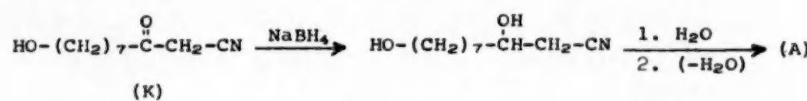
3-keto-10-acetoxydecanoate (H). Selective hydrogenation of the β -ketoester with ruthenium furnished ethyl 3-hydroxy-10-acetoxydecanoate (I). Hydrolysis afforded 3,10-dihydroxydecanoic acid (J) which was dehydrated with acetic anhydride to trans-10-hydroxy-2-deenoic acid (A).



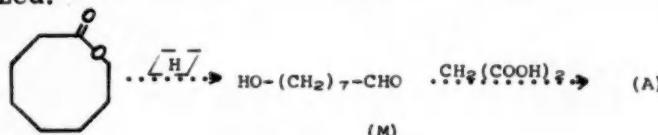
An alternate and more direct synthesis was realized reducing the number of discrete stages by two. Acylation of acetonitrile with ω -octanolactone (B) furnished the key intermediate, 3-keto-10-hydroxydecanenitrile (K). The nitrile was ethanolyzed to ethyl 3-keto-10-hydroxydecanoate (L), which may be readily converted to royal jelly acid via the previous scheme.



A workable five-stage pathway to trans-10-hydroxy-2-deenoic acid (A) was proposed utilizing 3-keto-10-hydroxydecanenitrile (K), which involves hydride reduction of K followed by successive hydrolysis and dehydration.



A fourth proposed pathway was studied which, although proving impracticable, presented a few provocative anomalies. The key intermediate in this case was to have been 8-hydroxyoctanal (M) which on decarboxylative condensation would be expected to furnish the desired acid (A). Attempted preparation of M by semireduction of ω -octanolactone utilizing various reducing agents that have precedence in their ability to partially reduce lactones was not realized.



No reduction was observed with sodium amalgam in acid or sodium borohydride at pH 3-4. Use of one equivalent of lithium aluminum hydride, sodium borohydride-aluminum chloride combination, or sodium trimethoxyborohydride afforded only 50% conversion to 1,8-octanediol, the product of a two-stage reduction of the lactone.

The fifth proposed pathway involved the acylation of diethyl malonate with ω -octanolactone to yield diethyl 8-hydroxyoctanoylmalonate, which might be envisioned to furnish royal jelly acid by selective reduction of the ketone carbonyl followed by hydrolysis, decarboxylation, and dehydration. Condensation of the lactone with diethyl malonate was not effected, as the expected unfavorable equilibrium could not be shifted to yield an appreciable amount of acylmalonate. In the process of studying the remainder of the sequence it was found that an acylmalonate, diethyl n-butyrylmalonate, may be selectively reduced to the corresponding alcohol by hydrogenation with ruthenium at elevated pressures. During the course of this investigation diethyl 1-methoxybutyridenemalonate and diethyl 1-acetoxybutyridenemalonate were prepared.

Microfilm \$2.75; Xerox \$3.80. 69 pages.

ADSORPTION OF CERTIFIED DYES BY STARCH

(Order No. Mic 61-2812)

George Zografi, Ph.D.
University of Michigan, 1961

The uneven coloring of compressed tablets is believed to be due primarily to migration of dye in the tablet granulation during drying. To understand the factors underlying dye migration with the aim of eventually learning to prevent or control it, a study of the adsorption of certified dyes on starch was undertaken. A group of five certified dyes, FD&C Red No. 1, FD&C Red No. 3, FD&C Blue No. 2, FD&C Yellow No. 5 and FD&C Green No. 1, was selected to represent the general types of certified dyes available. Starch was selected as one of the most commonly used tablet fillers, and six different types, corn, rice, wheat, potato, arrowroot and cassava, were investigated.

Adsorption data fitted the Langmuir equation in all cases, and constants of the Langmuir equation were evaluated. These indicated a consistent order of adsorption for the different dyes on a given starch, but no consistent difference between starches. Potato starch was an exception, not adsorbing any of the dyes investigated.

Increase in temperature caused decrease in adsorption, but the decrease was not as great as expected with the change from 40° to 50°. This was thought to be due to an increased swelling of starch at 50°.

No adsorption of dye from organic solvents occurred. Adsorption decreased with increasing concentration of ethyl alcohol, the data still following the Langmuir relationship. The degree of adsorption appeared to be correlated with the dielectric constant of the solvent mixtures, but water was essential to the adsorption process.

Acacia, sodium alginate, methylcellulose, sodium carboxymethylcellulose and polyvinylpyrrolidone had significant effects on dye adsorption depending on the particular gum-dye combination. Only PVP was consistent in its

effect on adsorption, causing a decrease with all dyes. The data followed the Langmuir equation and the constants were used to compare the various combinations.

Inorganic salts affected the adsorption of dyes on starch, but the effect was peculiar to the dye-salt combination.

Rates of dye adsorption at 30°, 40° and 50° were measured, and it was found that the rate increased rapidly with increase in temperature, although equilibrium adsorption was decreased at higher temperatures. At 30° equilibrium was reached in about 24 hours, at 40° in about 2 hours and at 50° within 10 minutes. Although rather long periods of time were required to reach equilibrium at the lower temperatures, 50% of equilibrium value was reached in a fraction of this time, making it appear that penetration and diffusion of dye molecules into the inner portions of the starch grain might occur. An empirical relation is presented, which describes the amount of dye adsorbed at a given time; this is:

$$C_t / C_\infty = t / (a + bt),$$

where C_t is the amount adsorbed at time, t , C_∞ is the amount adsorbed at equilibrium, and a and b are constants.

From the results of this study it appears that a chemical interaction with energy of low magnitude is involved, probably between the hydroxyl group of the amylopectin portion of starch and non-ionized polar groups of the dye molecules. Evidence indicates that the adsorption is not strictly a surface phenomenon but involves penetration and diffusion into the starch grain followed by chemical binding.

Microfilm \$2.75; Xerox \$8.60. 188 pages.

Mass Action. In one case the degree of dissociation was greater than one, a physically unrealistic value. Experimental results obtained with other systems by different investigators were in accord with the present results.

To account for the experimental results a simple model was presented. The polymer was thought to be comprised of a polyion plus its ionic atmosphere which excluded the simple salt and, hence, compressed it. The equation developed was tested with the experimental data presented. The agreement was good. Data for other systems reported by different investigators also confirmed the simple interpretation presented here.

Part II of this thesis was concerned with the study of the size and interactions of LiPP in aqueous solutions of LiBr employing light-scattering and viscosity experiments at 25°. The two LiPP samples used have average molecular weights of 4.3×10^5 and 5.5×10^5 . The molarities of LiBr solutions ranged from 0.90 to 1.80.

It was shown that when dilution of the polymer is carried out at constant salt concentration, correct molecular weights and second virial coefficient can be obtained from light-scattering experiments if appropriate thermodynamic quantities are available.

The solvent where all long-range interactions disappear (theta-solvent) was found to be 1.8N LiBr at 25°. This value was evidenced from the zero slope of the light-scattering curve in 1.8N LiBr, as well as from the plot of the second virial coefficient (B) against the salt concentration extrapolated to B=0. This value is in line with the previously observed phase separation results.

The ratio of the root-mean-square end-to-end distance of the unperturbed sodium polyphosphate molecules and the degree of polymerization was found to be 6.6 and 6.4 angstroms for the higher and lower average molecular weights, respectively. Using reported values for the appropriate bond angles and bond lengths, the corresponding ratio for unperturbed and sterically unhindered molecules is 3.7 Å. Hence, the ratio of these respective values, 1.8 and 1.7, is a measure of the steric hindrance to rotation for lithium polyphosphate molecules. The same value was reported for sodium polyphosphate.

Flory's theory was used to test the ionic strength dependence of the molecular expansion of lithium polyphosphate in aqueous lithium bromide solutions. The results indicate an incompatibility of the solvent for the associated (LiPO_3) groups. Also, the results were interpreted to give 0.12 for the degree of dissociation of the polyelectrolyte, a value somewhat smaller than that obtained from electrophoresis experiments.

Using the thermodynamic interpretation of the second virial coefficient along with activity data from the literature, membrane data from Part I of this thesis and the value of 0.17 for i together with the data in Part II of this thesis, each term in the second virial coefficient was evaluated. It was found that the Donnan term and the polymer-polymer interaction term are positive, thereby indicating an affinity of the (LiPO_3) groups for water, while the polymer-salt interactions is negative indicating an incompatibility of the salt for the associated (LiPO_3) groups.

Microfilm \$2.75; Xerox \$6.00. 125 pages.

CHEMISTRY, PHYSICAL

PART I - A SIMPLE INTERPRETATION OF DONNAN EQUILIBRIUM OBTAINED WITH LONG-CHAIN POLYPHOSPHATES. PART II - MOLECULAR SIZE AND INTERACTIONS OF LITHIUM POLYPHOSPHATE IN AQUEOUS SOLUTIONS OF LITHIUM BROMIDE.

(Order No. Mic 61-2172)

Paul Ander, Ph.D.
Rutgers University, 1961

Major Professor: Dr. Ulrich P. Strauss

Part I of this thesis presents results obtained by carefully equilibrating the electrolyte solution containing a polyphosphate against a solution of the same electrolyte without polyphosphate through a membrane impermeable to the macro-ion but permeable to all small ions. Conditions were experimentally adjusted so that only one counterion species was present at equilibrium.

It was shown that when deviations from ideality were neglected at infinite dilution of the polymer, the computed values of the degree of dissociation varied directly with the salt concentration, thereby contradicting the Law of

THE EFFECT OF DIELECTRIC CONSTANT
ON THE RATE OF REACTION BETWEEN
2,4-DINITROPHENYLHYDRAZINE
AND SOME KETONES.

(Order No. Mic 61-2636)

Max Barth, Ph.D.
New York University, 1955

Adviser: Joseph D. Gettler

For years the wide variation in the ease of condensation of typical carbonyl reagents such as hydroxylamine, semi-carbazide, hydrazine and substituted hydrazines with carbonyl compounds has occupied the attention of numerous investigations. Investigators have undertaken kinetic studies of this general type reaction and attempted to correlate the structure of carbonyl compounds with relative reactivity. There is a considerable dearth of available data; many of the accumulated data are of dubious value; and many of the data are confusing and even contradictory. Most earlier attempts at the correlation of structure with relative rates for this general reaction type were presumably unsuccessful because of the failure to consider the all-important effect of internal kinetic energy or entropy influences on rates of reaction. One recent hypothesis was apparently successful in establishing a correlation between a presumed order of rigidity and calculated entropies of activation. This relationship was valid for semicarbazone formation for a restricted series of compounds in one set of environmental conditions.

The present research was undertaken in order to test an extension of the above mentioned successful correlation which predicted a monotonic response of rate to dielectric constant. It was also undertaken to extend appreciably the available information on the kinetics of the hitherto un-studied reaction between 2,4-dinitrophenylhydrazine and carbonyl compounds. Careful control of experimental conditions, the elimination of the effects of trace impurities by rigorous purification of solvents and reactants and the successful application of an iodometric method of analysis permitted the precise measurement of the rates of 2,4-dinitrophenylhydrazone formation of six ketones over a rather wide dielectric constant range. Precise specific rate constants at 20° were obtained for acetone, methyl ethyl ketone, methyl isopropyl ketone, diethyl ketone, cyclopentanone and pinacolone at dielectric constant values of 30.1, 42.0 and 48.0.

An examination of the experimental results indicated that 2,4-dinitrophenylhydrazone formation was a reversible system consisting of a second order forward step and a pseudo-first order reverse step. For a particular ketone the rate did not show a monotonic response to dielectric constant but passed through a minimum. Finally, the variation of rate of 2,4-dinitrophenylhydrazone formation of a given ketone with a dielectric constant did not show an effect dependent on the structure of the ketone.

Microfilm \$2.75; Xerox \$3.00. 52 pages.

THE RADIATION CHEMISTRY OF
NORMAL PROPYL CHLORIDE

(Order No. 61-2940)

Herbert Linne Benson, Jr., Ph.D.
The University of Wisconsin, 1961

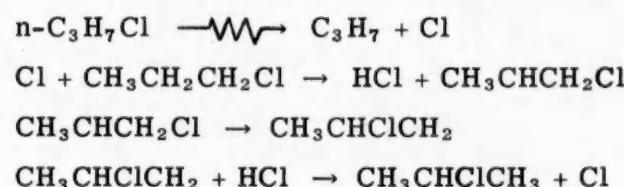
Supervisor: Professor John E. Willard

A study of the radiation chemistry of normal propyl chloride has been made as part of a program of investigations of the radiolysis of organic halides. The work is designed to provide a better understanding of the elementary steps in the mechanisms of chemical reactions induced by the absorption of ionizing radiation. The effects of absorbed dose of Co⁶⁰ gamma radiation, intensity, product concentration and added radical scavengers upon the radiolysis products of n-C₃H₇Cl have been studied. Mechanisms which can account for the observed characteristics of the decomposition have been postulated.

The irradiation of pure n-C₃H₇Cl produces a total of eighteen organic compounds. With the exception of iso-C₃H₇Cl, the initial yields of these compounds are linear with dose. Their G values are: CH₄, 0.11; C₂H₆, 0.09; C₃H₈-C₃H₆, 4.3; n-C₆H₁₄, 0.13; CH₃Cl, 0.23; C₂H₅Cl, 0.13; sec-C₆H₁₃Cl, 0.25; n-C₆H₁₃Cl, 0.11; 1-Cl-2-Me-Pentane, 0.14; 1,1-C₃H₆Cl₂, 0.32; 1,2-C₃H₆Cl₂, 0.59; 1,3-C₃H₆Cl₂, 0.07; three isomers of C₆H₁₂Cl₂, 1.64; two unidentified compounds, 0.20. In the presence of 1 mole per cent iodine, the yields of these compounds are either eliminated or greatly reduced.

G(iso-C₃H₇Cl) increases with an increase in absorbed dose. The differential G values increase from approximately zero at the start to 36 at 6 x 10²⁰ e.v./gm. and to 60 at 13.5 x 10²⁰ e.v./gm. In the presence of average concentrations of HCl from 0.2 and 2.4 mole per cent at a constant dose of 1.6 x 10²⁰ e.v./gm., G(iso-C₃H₇Cl) increases as the first power of the HCl concentration, varying from a value of 15 to a value of 180.

In the presence of tritium-labeled HCl, the formation of iso-C₃H₆H³Cl is observed in amounts equal to the gross yield of isopropyl chloride if a reasonable isotope effect of 5 is assumed. A 3 1/2-fold increase in the radiation intensity decreases G(iso-C₃H₇Cl) by approximately one-half while irradiation in the presence of 1 mole per cent iodine scavenger reduces G(iso-C₃H₇Cl) to a constant value of 0.4. The following free radical chain mechanism has been postulated to explain the formation of iso-C₃H₇Cl:



Investigations of the radiolysis of n-C₃H₇Cl in the presence of added C₃H₆, HCl³⁶ and I₂¹³¹ have also been made. The results of these experiments are in agreement with the postulated mechanism for the isomerization process.

HCl was the only inorganic product studied. Radiolysis of pure n-C₃H₇Cl at 25° yields a G(HCl) of 5 which is not changed in the presence of 0.05 mole per cent iodine. At -75°, a decrease in G(HCl) of approximately 25% is observed.

The organic products formed in the photolysis of $n\text{-C}_3\text{H}_7\text{Cl}$ are identical to the radiolysis products except for some minor compounds. The ratios of the yields in the two systems appear to be the same. Photolysis in the presence of 1 mole per cent HCl causes a 10-fold enhancement in the relative quantum yield of iso- $\text{C}_3\text{H}_7\text{Cl}$. These observations indicate that ions are not involved in the elementary reactions producing the radiolysis products.

To determine if the HCl catalyzed isomerization of $n\text{-C}_3\text{H}_7\text{Cl}$ is a unique process for that compound, the radiolysis of $n\text{-C}_4\text{H}_9\text{Cl}$ has been briefly investigated. $G(\text{sec-C}_4\text{H}_9\text{Cl})$ increases at a constant dose from 8.5 for initially pure $n\text{-C}_4\text{H}_9\text{Cl}$ to 107 in the presence of 2.5 mole per cent HCl. In addition, a $G(\text{HCl})$ of 4.7 has been observed in the radiolysis of $n\text{-C}_4\text{H}_9\text{Cl}$.

Microfilm \$2.75; Xerox \$9.25. 202 pages.

THE METACHROMATIC REACTION OF HEPARIN

(Order No. Mic 61-2643)

Emory Harold Braswell, Ph.D.
New York University, 1961

Adviser: S. Z. Lewin

This investigation was undertaken in order to gain new insights into the mechanism of metachromasia.

The visible absorption spectra of the dye, toluidine blue O, were studied as a function of dye concentration from about 3×10^{-6} to 1×10^{-2} M in aqueous solutions, and in solutions containing 0.01 to 1.0 M NaCl. An equilibrium constant for a dimerization reaction was calculated from these data. However, it is pointed out that although the dye may aggregate or polymerize, it does not undergo a simple dimerization. Increasing the NaCl concentration increases these equilibrium constants.

The visible absorption spectra of mixtures of 3×10^{-6} to 2×10^{-3} M toluidine blue O, and 6×10^{-6} to 0.1 N heparin (sodium) were studied both in the absence of, and in the presence of NaCl (0.01 to 1.0 M). The presence of NaCl reduces the metachromatic effect and promotes precipitation.

A quantitative attempt to interpret the spectral changes that occur in heparin-dye mixtures in terms of an equilibrium involving two absorbing species, i.e., a reacting and a product species, failed. A current theory which has been of value in describing metachromatic phenomena involves the idea that the tendency of certain dye molecules to aggregate or "stack" is increased when the dye is adsorbed by a polyelectrolyte. This theory, which assumes the presence of two absorbing species in solution, i.e., a stacked and an unstacked complex, would appear to need modification as a result of this investigation.

A precipitate forms whenever the ratio (p/d) of the concentration of heparin anionic sites to that of dye molecules is less than about 1. The amount of dye present in the precipitate is approximately equal to that which would be expected if 1 dye molecule was attached to each heparin site. The presence of salt was found to affect strongly the value of p/d at which precipitation occurs, but leaves the composition of the precipitate relatively unchanged.

As the dye concentration was varied at higher heparin concentrations, the value of p/d at which the metachromasia ratio (the ratio of the optical density at the wavelength of maximum absorption of the metachromatic complex to that at the wavelength of maximum absorption of the free dye in solution) was found to be a maximum, is relatively constant at 12. This may indicate that 1/12 of the heparin sites are arranged so as to permit the maximum opportunity for adsorbed dye molecules to aggregate.

A large excess of heparin diminishes the metachromatic effect. The concentration of a particular heparin required to reduce the metachromasia ratio to an arbitrary value at a fixed dye concentration was found to be related to the degree to which the dye deviates from the Beer-Bouguer absorption law. This is strong evidence that the factors responsible for this deviation are involved in the production of metachromasia.

Several heparin samples of different anticoagulant activities were subjected to these studies. A correlation was found between the activity and the metachromatic ratio of the precipitate. This value was determined by measuring the visible absorption spectrum of the suspension before centrifugation, and the solution after centrifugation. There also may be a correlation between the activity and both the value of the maximum metachromasia ratio and the concentration of heparin needed to reduce the metachromasia ratio to an arbitrary value. The presence of salt, however, interferes with this correlation.

Microfilm \$3.35; Xerox \$11.70. 260 pages.

THE BINDING OF DYES AND POLYSACCHARIDES IN AQUEOUS SOLUTIONS

(Order No. Mic 61-2178)

Herbert Chiu-Ching Cheung, Ph.D.
Rutgers University, 1961

Major Professor: Benjamin Carroll

The binding of dyes in aqueous solutions of polysaccharides has been studied. Cationic methylene blue and anionic Congo red were used. The polysaccharides consisted of solvent-fractionated amylose, amylopectin, hydrolyzed fragments of amylose in addition to mixtures of amylose and amylopectin from different botanical origins, and carboxylated starches. Also used were amylodextrins which were isolated from column chromatography. Data were obtained concerning the effects of charge, molecular size, and degree of branching, and other configurational aspects of these macromolecules.

For the interaction of methylene blue and carboxylated polysaccharides, the dye was found to be adsorbed in the dimeric form. It was found that the binding affinity was dependent upon the degree of carboxylation. The free energy of binding per mole of carboxylate group was -5.82 kcal. at 27°C , and -6.35 kcal. at 40°C . The corresponding change in enthalpy was +6.31 kcal., and that in entropy was +40 e.u. An analytical procedure was developed based on the invariancy of the binding affinity at 0.01 ionic strength for the determination of carboxyl content in starch.

By selecting a carboxylated starch with low carboxyl content, it was possible to test the validity of the Klotz

adsorption isotherm. This involved extrapolations to infinite concentration of the ligand and zero concentration of the competitive buffer ions. A 1-1 correspondence between the carboxylate groups and the dimerized ligand was obtained. This may be regarded as supporting evidence for the above adsorption equation. The invariability of the binding affinity of the carboxylate group for methylene blue at infinite dilution of the ligand suggests the possibility that other functional groups may be quantitatively assayed using the dye adsorption technique.

The competitive effect of the cations of the buffer was evaluated for the binding of methylene blue and carboxylated starch. The change in free energy for the interaction of the substrate and the cations was found to be -3.0, kcal. at 27°C and -3.8, kcal. at 40°C. The corresponding changes in enthalpy and entropy were +13.7 kcal. and +56 e.u., respectively.

The binding constant for the first Congo red ion complexed with linear polysaccharide was 1.32×10^4 at 23°C. This value was reasonably constant from maltoseheptadecaose (17 glucose units) to amylose having 860 glucose units. Below 17 glucose residues, the binding affinity decreased rapidly and vanished at an average chain length of 4.6. For the binding of amylose, the change in enthalpy was +13.3 kcal.-mole⁻¹, and the change in entropy was +81 e.u.

The degree of branching of polysaccharide was found to decrease markedly the extent of binding of Congo red. Because of the sensitivity of this dye toward branching and insensitivity toward variation in chain length, a method was developed for assaying amylose content in starch. The suggestion is offered that branching in other types of high polymer may be determined by adsorption procedures.

The effect of charge of the substrate on the binding of Congo red was investigated using carboxylated starches. Contrary to current concepts, the binding affinity of this negative dye and carboxylated starches was found to be about the same as that in unmodified starches. An explanation has been suggested for this phenomenon.

Viscosity measurements were made on the amylose-Congo red complex. The results indicated a decrease in the hydrodynamic volume of the complex over that of the starch itself.

The binding of methylene blue and carboxylated polysaccharides has been shown to be predominantly electrostatic. The interaction of Congo red and polysaccharides may be interpreted in terms of hydrophobic bonding and configurational changes of the substrate.

Microfilm \$2.75; Xerox \$8.80. 195 pages.

PHYSICAL CHEMICAL STUDIES OF THE PRECIPITIN REACTION. THE INTERACTION OF BOVINE SERUM ALBUMIN AND ITS CHICKEN ANTIBODIES.

(Order No. 61-2948)

Donald David Donermeyer, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor J. W. Williams

The early investigations of the precipitin reaction, bovine serum albumin (BSA) antigen - anti-BSA chicken

antibody have appeared to show unique behavior. Wolfe and coworkers found that the optimal condition for the maximum precipitation of these antibodies was to carry out the reaction in 1.5 M NaCl medium. By means largely of electrophoretic analysis, Banovitz, Singer and Wolfe have reported that the mole ratio of bound antigen to bound antibody was 0.9. On the basis of this observation they concluded that the antibodies produced against BSA were either a mixture of univalent and bivalent molecules or were weakly reacting bivalent molecules, but the evidence presented hardly supports such conclusions. Makinodan, Gengozian and Canning detected the presence of a normal serum macroglobulin in these antigen-antibody complexes, when these systems were analyzed in the ultracentrifuge, but this protein was not resolved on electrophoresis.

It occurred to us that the experiments must be carried out under conditions such that the existence of this macroglobulin could be detected, its amount measured, and its presence taken into account. This was achieved by using sedimentation analysis to evaluate the experiments. Now, with entirely conventional and well-established methods of analysis, the mole ratio of BSA to its chicken antibody approaches the value two as the relative amount of antigen in the system is increased.

The macroglobulin was present in all sera studied, whether normal or immune, as well as in solutions of the soluble complexes. Some of the physical properties of this molecule were determined. At the equivalence point it amounted to nearly forty percent of the total precipitated globulins.

These and other data are discussed in the terms of the Goldberg theory for reactions of multivalent antigen with univalent and bivalent antibody. The analysis of the composition of the aggregates agrees closely with that predicted by Goldberg. Also, the theory enables us to demonstrate that the precipitating antibodies cannot be a mixture of univalent and bivalent molecules. Arguments of Wolfe and co-workers suggesting that the increased precipitation in 1.5 M NaCl is specific have been reinterpreted by giving a satisfactory account of their observations based on the proposition that the inert macroglobulin is occluded in the precipitate. The theory also is used to derive equations applicable to some selected problems. The importance of a knowledge and understanding of this theory has been emphasized in the dissertation.

We conclude from our physico-chemical studies of the soluble complexes of the BSA anti-BSA chicken antibody system that there is nothing inconsistent with the results we obtained as compared to those available for the antibody valence and the combining power of antigen and antibody in the rabbit and horse antibody systems.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

ADSORPTION PROPERTIES OF HYDROGEN AND OXYGEN ON PLATINUM BLACK AND CARBON SUPPORTED PLATINUM FROM 20 TO 300 DEGREES KELVIN

(Order No. Mic 61-2366)

Robert Amos Fisher, Jr., Ph.D.
The Pennsylvania State University, 1961

The adsorption properties of hydrogen and oxygen on platinum black and carbon black supported platinum have been studied from 20 to 300 °K. This investigation was carried out using two adiabatic calorimeters designed and constructed in this laboratory.

Platinum black outgassed at 200 °C was found to have a complete monolayer of oxygen which could be removed at the ice point using a "thermally indicated titration." This titration was carried out by observing the heat effect calorimetrically when hydrogen was added to the system. The end point was indicated by a sharp decrease in the differential calorimetric heats. A back titration using oxygen to remove adsorbed hydrogen was also successfully carried out. The cleaned platinum black sintered easily at 70-100 °C whereas the oxygen covered platinum surface showed no sintering at 200 °C.

Rare gas adsorption data (differential heats and isotherms) were used to characterize the topography of the platinum black surface. This method showed that the cleaned platinum surface possessed only a small amount of macroscopic heterogeneity.

Values for the energy of interaction of the rare gases and platinum were calculated using the several theoretical expressions which take account of the metallic properties of the adsorbate. The experimental values for the differential heats of adsorption for the rare gases were in reasonable agreement with these calculated values.

Both weak (d valencies) and strong (dsp valencies) hydrogen chemisorption seems to occur on platinum black with an activated transition from weak to strong chemisorption taking place. Van der Waal's adsorption is a precursor of weak chemisorption so that, because of the energy of activation, only physical adsorption is observed at sufficiently low temperature. However, not all parts of the platinum surface are of the same activity and at low coverage hydrogen is chemisorbed with no activation energy down to at least 60 °K.

The heat capacity of a monolayer of chemisorbed oxygen indicates that it behaves as a two dimensional gas, the heat capacity being made up of a complex superposition of vibrational and hindered translation-rotation contributions. No heat capacity contribution for hydrogen chemisorbed on platinum was found. This is to be expected because of the increased rotational and vibrational frequencies involved since the hydrogen atom is only 1/16 the mass of an oxygen atom.

On carbon black supported platinum the behavior of hydrogen is essentially the same as that for platinum black. Oxygen, however, does not chemisorb on the carbon black supported platinum to any appreciable extent at 280 °K.

This behavior is explained by postulating a carbon-platinum bond existing at the surface thus preventing formation of the strongly ionic oxygen-platinum bond.

Chemisorbed hydrogen on the surface was removed by using a thermally indicated titration with oxygen. This

was possible since the carbon surface not covered with platinum was covered with oxygen which could not be removed by the degassing at 100 °C.

Microfilm \$2.75; Xerox \$9.00. 199 pages.

KINETIC STUDIES OF THE REACTION OF PYRIDOXAL AND ALANINE

(Order No. 61-2952)

George Morrison Fleck, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Robert A. Alberty

Kinetics of the reaction of pyridoxal and alanine in aqueous solution have been studied at 25.0 °C by observing the changes in visible and ultraviolet absorbancy and in optical rotation which occur following mixing of the reactants.

When the initial alanine concentration is much greater than the initial pyridoxal concentration, the absorbancy of the solution changes with time according to the equation

$$A_t + B_0 + B_1 e^{-m_1 t} + B_2 e^{-m_2 t} + B_3 e^{-m_3 t}$$

where A_t is the absorbancy at time t , and m_1 , m_2 and m_3 are pseudo first order rate constants in order of decreasing magnitude. The m 's are functions of initial alanine concentration and of the rate constants for a particular mechanism. The B 's are functions of the m 's, initial reactant concentrations and absorbancy indices of the reactants, products and intermediates.

At pH 8.00 the pseudo first order rate constant m_1 is of the order of 10^{-1} sec^{-1} , m_2 is about 10^{-3} sec^{-1} and m_3 is about 10^{-6} sec^{-1} . Since the m 's are of such different magnitudes, it is possible to choose time intervals during which the time dependence of the absorbancy is given by the equation

$$\ln |A_{t+\tau} - A_t| = -m_r t + \text{constant}, r = 1, 2, 3$$

where A_t and $A_{t+\tau}$ are the absorbancies at time t and at a later time $t + \tau$. The values of the m 's were determined from plots of $\ln |A_{t+\tau} - A_t|$ versus time. Experimental values of these kinetic parameters are independent of the wavelength of light employed for the absorbancy measurements over the range from 3000 to 5000 Å.

Detailed investigation of the dependence of the pseudo first order rate constant m_2 on initial reactant concentrations, pH and ionic strength has been made, with pH and ionic strength adjusted by the addition of sodium hydroxide and sodium acetate. No dependence on initial pyridoxal concentration was observed when the pyridoxal concentration was varied ten fold. At each of seven values of pH in the range from 8.00 to 10.40, m_2 is a linear function of initial alanine concentration (A_0), and is represented by the equation

$$m_2 = a_2(A_0) + b_2$$

where a_2 and b_2 are pH-dependent parameters. Both a_2 and b_2 increase in magnitude with increasing pH. In a typical experiment, deviation from mean values for

a_2 and b_2 averaged about five per cent when ionic strength was varied over the range from .025 to .10.

When the initial concentration of L-alanine is much greater than the initial pyridoxal concentration, the time-dependence of optical rotation is characterized by the equation

$$\ln(a_t - a_{t+\tau}) = -m_a t + \text{constant}$$

where a_t and $a_{t+\tau}$ are the observed rotations at times t and $t + \tau$, and m_a is a pseudo first order rate constant.

It is concluded that at least three spectrally-distinct compounds are formed by the reaction of pyridoxal and alanine. Integrated rate equations have been derived for three classes of reaction mechanisms consistent with the data at constant initial alanine concentrations. Methods for distinguishing between these mechanisms are discussed.

Microfilm \$2.75; Xerox \$4.80. 93 pages.

STRAIN POTENTIAL OF A METAL ELECTRODE IN A DIELECTRIC LIQUID

(Order No. Mic 61-2428)

Roger George Gymer, Ph.D.
Case Institute of Technology, 1961

The potential transient obtained when a copper wire electrode is plastically strained in methyl methacrylate monomer and in partially polymerized monomer has been measured in an experimental investigation of strain electrometry and of the nature of the deformation processes in a metal. Selected features of the transient growth and decay have been characterized.

The experimental results can conveniently be divided into two essentially independent portions: the growth of potential as the electrode is strained, and the decay of the transient after strain. Each appears to depend upon separate experimental parameters.

The potential is measured relative to an unstrained reference wire. On strain, the electrode assumes a negative potential with respect to the reference electrode, as also is true for contact between the metal and the solid polymer. In the region of plastic behavior of the metal, the build-up of potential during the process of deformation of the wire shows a linear dependence on the applied stress but it shows a marked deviation from linearity at the yield stress. The stress must exceed a value near the proportional limit before any appreciable potential is obtained. The dependence of the strain potential upon the degree of strain, strain rate, and molecular weight of the dielectric have been determined.

A tentative interpretation of the relation of potential to stress is given in terms of dislocation movement. The dependence of the potential change on the rate and degree of deformation, as well as upon the mechanical properties of the metal shows promise of giving additional information about the mechanisms of plastic deformation.

The time decay of the transient depends upon the nature of the solution surrounding the electrode and appears to be independent of the factors influencing the growth of the strain potential.

Microfilm \$2.75; Xerox \$5.40. 106 pages.

ROTATIONAL STATES OF A RIGID TETRAHEDRON IN A CUBIC CRYSTAL

(Order No. Mic 61-1991)

Harry Frederick King, Ph.D.
Princeton University, 1960

Vedder has recently observed the infrared spectra of alkali halide single crystals in which about 0.1% of the positive ion sites are occupied by ammonium ions. At liquid helium temperature the 1400 cm^{-1} absorption band corresponding to the NH bending mode exhibits a complicated fine structure with line spacings of a few wave numbers. The spectra correspond neither to free rotation nor to one-dimensional rotation — motions postulated for the NH_4^+ in the high temperature phases of ammonium halides. It was suggested that the fine structure corresponds to transitions among hindered rotational states of the NH_4^+ ion in the lattice.

A simple point charge model suggests that the main features of the well-studied ammonium halide crystals may be accounted for in terms of electrostatic forces between the ammonium ion and the lattice. A calculation of this sort predicts that in alkali halide crystals the NH_4^+ ion is restrained from assuming certain discrete orientations, but is nearly free to move through a complicated maze of potential valleys. This calculation also suggests that the potential function is well represented by a two or three term expansion in spherical top functions.

Numerical solutions are obtained to the quantum mechanical equations of motion for a rigid tetrahedron rotating in a cubic lattice. The Hamiltonian is written

$$H = T + V(\phi \theta \psi)$$

where T is the kinetic energy operator of a spherical top and $V(\phi \theta \psi)$ is the potential, a function only of the Euler angles. The problem is approached by considering the

angular momentum operator \vec{L} and its projections along Cartesian axes fixed in space and also along axes fixed in the rotating body. For this situation there exist three independent, commuting angular momentum operators L_z^2 , L_z and \bar{L}_z where z and Z refer to space-fixed and body-fixed coordinate systems respectively. The eigenfunctions

$|J M \bar{M}\rangle$ of the operators are taken to be the basis functions for expressing the potential function $V(\phi \theta \psi)$ as well as the wave functions. The coupling scheme for two sets of operators L_1^2 , L_{z1} , \bar{L}_{z1} and L_2^2 , L_{z2} , \bar{L}_{z2} is discussed and shown to be a simple extension of the well-known coupling scheme not involving body-fixed angular momentum operators. The angular momentum operators are used to define rotational operators of a space-fixed and of a body-fixed symmetry group. The total Hamiltonian is invariant under the direct product of these two groups. Projection operators are obtained which generate symmetry-adapted linear combinations of the $|J M \bar{M}\rangle$ functions. Computer programs were written which carry out the projections, and then compute the Hamiltonian matrix elements in the symmetry-adapted basis, and finally obtain the eigenvalues and eigenvectors of the resulting matrices. All angular momentum functions with $J \leq J_{\max}$ were included in the expression of the wave functions.

For some symmetry species $J_{\max} = 29$, in all cases $J_{\max} \geq 13$.

The solutions correspond to bound oscillator states in a CsCl-type lattice and to quasi-rotational states in a NaCl-type lattice. In the latter the low lying energy levels are only weakly dependent upon the strength of the crystal field (in qualitative agreement with the observed infrared spectra); however, computed energy levels do not permit an assignment of the observed spectral lines which are apparently split by vibration-rotation interaction in the vibrationally excited state.

Microfilm \$2.75; Xerox \$7.20. 155 pages.

RADIATION-INDUCED ELECTROLYSIS CURRENTS

(Order No. Mic 61-2633)

Julius Klerer, Ph.D.
New York University, 1958

Adviser: S. Z. Lewin

This investigation comprises studies of the effects of x-irradiation upon (a) the magnitude of the current flowing between two bright platinum electrodes as this current decreases to the so-called "residual current" level, (b) the magnitude of the cell current when the electrodes are individually irradiated, and (c) the cell currents for electrodes of gold and of platinum. These studies were carried out in aqueous media as a function of polarizing voltage, acidity, added solute (hydrochloric acid, sulfuric acid, perchloric acid and their sodium salts), presence and absence of dissolved gases and stirring of the individual electrodes. In addition, the "residual current" in the absence of radiation was studied as a function of polarizing voltage, acidity, electrode spacing and electrode composition.

These studies have established that the effect of x-irradiation is different on a platinum surface that is anodically polarized compared to an otherwise equivalent surface that is cathodically polarized. Furthermore, the magnitude of the radiation-induced change in cell current has been found to depend upon the degree of polarization of the electrode, and the presence of adsorbable or reactive solute species in the vicinity of the electrode. X-radiation appears to act as an anode depolarizer by producing species, such as HO_2 and H_2^+ , that desorb a chemisorbed layer at the electrode-solution interface. However, at the electrode that is not current-limiting the adsorption of radiation-produced species leads to a progressive polarization of that electrode. In the case of irradiation of a gold anode (connected to a gold cathode), the principal effect of radiation is to produce hydrogen peroxide which then reacts at the electrode.

Investigations of the residual current lead to the conclusion that this current is limited by the extent of polarization of either or both electrodes by the formation of a chemisorbed layer (platinum) or by oxide formation (gold). The current-limiting electrode is postulated to be the anode in the systems platinum anode-platinum cathode, platinum anode-gold cathode, gold anode-platinum cathode, and to be the cathode in the system gold anode-gold cathode, the electrolyte being 0.1 M sulfuric acid.

In addition, an estimate has been made of the relative contributions of radiation-produced radicals and stable species to the current effects observed, and a coulometric method has been developed for the semi-quantitative estimation of minute amounts of hydrogen peroxide.

Microfilm \$2.75; Xerox \$7.80. 166 pages.

ELECTRODE KINETICS IN THE SYSTEM SILVER-MOLTEN SILVER NITRATE

(Order No. Mic 61-1413)

Leonard Nanis, Eng.Sc.D.
Columbia University, 1961

A study of electrode kinetics for electrodeposition and solution of silver from pure molten silver nitrate has been possible through the use of (a) a specially designed circular electrode containing a rigidly fixed internal silver reference electrode, (b) contact of the electrode with silver nitrate through a meniscus so as to insure uniform current distribution and (c) correction for ohmic potentials by a new a.c. method.

Use of pure salt eliminated concentration polarization. Electrolysis in a vacuum cell prevented anode film formation as confirmed by separate measurements of the resistivity of silver oxide. Cathodic nucleation overvoltage was eliminated on theoretical grounds.

Measured potentials (0.002 mV resolution) consisted of activation overvoltage, ohmic potentials, and a hitherto unreported extended transient potential for both anode and cathode.

Cathode activation overvoltage was found to be less than 0.02 mV for current densities up to 10 mA/cm^2 for all temperatures in the range $210\text{--}260^\circ\text{C}$. Current densities ranged from 0.001 to 100 mA/cm^2 in this study. Exchange current densities on the order of $1\text{--}5 \text{ A/cm}^2$ were found for the electrodeposition and solution of silver.

Because of the importance of ohmic potentials in fused salt overvoltage measurements, a detailed consideration was given to the relation of ohmic potentials to methods of measurement and electrode configuration. A general approach was developed based on the distribution of potential between electrodes. Existing correction factors for ohmic drop as a function of current density were shown to be special cases for idealized electrode geometry. The current distribution over a planar electrode of finite width in the presence and absence of electrode polarization was utilized to illustrate practical limitations of any correction formula for ohmic potential. The assumption of a probe electrode approximating a mathematical point in the electrolyte was shown to be a poor one because of field distortion by the finite size of the probe. The direct correspondence between overvoltage measurement by the probe method and certain continuously conductive analog methods used for the solution of potential distribution problems formulated the basis for the development of a method for correction of overvoltage measurements for ohmic potentials. In this method, the actual electrolysis cell is used as an analog model with alternating current of sufficiently high frequency to eliminate polarization. The fraction of the total electrical field between the anode and cathode intercepted by the reference probe together with the field

distortion caused by the presence of the probe are measured directly *in situ* and applied as a correction term to potentials arising from d.c. electrolysis.

The transient potentials were shown to be unrelated to double-layer charging by calculations using measured time-potential curves, in agreement with the measured frequency independence of cell resistance. Calculations were also made to demonstrate the non-association of the transients with Peltier and Joule heating effects arising from current passage at the electrode-electrolyte interface. Evidence is presented which supports a proposal that transient potentials are caused by slight changes in the fractional coverage of the electrode by adsorbed oxygen resulting from the thermal decomposition of silver nitrate.

The occurrence of non-uniform electrodeposition in the Ag/AgNO₃ and other systems is explained by a general theory which compares the magnitude of overvoltage with the crystallographic orientation dependence of metal-electrolyte absolute potential differences.

Microfilm \$3.15; Xerox \$11.05. 242 pages.

EFFECTS OF VARIOUS PROCESSING TREATMENTS ON STERILE CONCENTRATED MILK

(Order No. 61-2973)

Surendra Tribhuvandas Patel, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Harold E. Calbert

Dairy scientists have encountered several problems in the development of the sterile concentrated milk. The main problems have been to obtain commercial sterility of the product, and at the same time to prevent sedimentation, age thickening, and gel formation.

During this research work attempts were made to produce a product with better shelf-life and to have a processing procedure that was feasible commercially. To accomplish this, various processing procedures were tried.

The purpose of this specific research study was to determine the physical changes that occurred in sterile concentrated milk during storage as a means of evaluating variations that were used in the processing procedures for making the product.

To study the influence of various processing treatments on the behavior of sterile concentrated milk during storage, and as a means of predicting the behavior, tests known as accelerated gelation-flocculation test as proposed by Giroux and solubility index measurements were used.

The desired viscosity is an important factor which contributes to the shelf-life of the sterile concentrated milk. It is one of the most important factors in evaluating the keeping quality of the product during storage.

The apparent viscosity of the finished product after storage at 34°F., 70°F., and 110°F. was measured at 70°F. This measurement was done by the use of a modified Gardner Mobilometer. Solubility index measurements were made according to the test procedure given by Amer-

ican Dry Milk Institute. The sterile concentrated milk examined in this study was made by a batch process and by a continuous method developed by research workers in the Department of Dairy and Food Industry, University of Wisconsin.

Some of the variations in the processing procedure for making sterile concentrated milk that were found to influence the keeping qualities of this product as determined by apparent viscosity measurements were as follows:

(a) The adjustment of the pH of the concentrated milk to 6.6 - 6.8 prior to sterilization improved the keeping qualities of the product made by the batch process but had little influence on the shelf-life of the product made by the continuous process.

(b) The keeping quality of the finished product processed by the batch process, was increased by the use of a forewarming treatment of 165°F./30 min. on the whole milk, whereas in the continuous processing a forewarming treatment of 185°F./30 min. increased the shelf-life of the product.

(c) When using the batch procedure the holding of the sterile concentrated milk in the processing kettle at 200°F. prior to homogenization had little beneficial effects.

(d) While homogenization at a temperature of 180°F. in the sterile concentrated milk processed by the continuous process gave slightly better keeping qualities in the finished product when this was the only variable considered, a homogenizing temperature of 150°F. proved most satisfactory when used with other desirable variations in the processing procedure.

(e) When using the continuous process homogenization pressure in the range of 4000 p.s.i. seemed to give a product with the best keeping qualities.

Microfilm \$2.75; Xerox \$5.80. 120 pages.

ION-EXCHANGE IN CONCENTRATED ELECTROLYTE SOLUTIONS

(Order No. Mic 61-1065)

Walter A. Platek, Ph.D.
The University of Buffalo, 1961

The selectivity coefficients for the ion-exchange reaction:



have been determined at external molalities of LiCl ranging from 0.1 to 13.5 and in fused LiCl at 650°C. Both the organic exchanger, Dowex-50 and the inorganic exchanger, the Linde Molecular Sieve, were employed in these studies with the aqueous systems. Only the inorganic exchanger was used with the fused systems. The counter ions, Na⁺, Rb⁺, Cs⁺ and H₃O⁺ (used only with Dowex-50), represented above by M, were employed at low concentration levels so that the mole fraction of LiCl in resin and liquid phases was essentially unity. The observed results for exchanges involving Dowex-50, a steady decrease in selectivity for all exchanges except those involving H₃O⁺, have been explained in a qualitative fashion by the variation in ionic hydration and enhancement of binding due to reduced microscopic dielectric constant between the ion and the matrix within the resin phase.

A quantitative explanation based on the plausible assumptions that the resin may be treated as a highly concentrated electrolyte solution having only one diffusible ion and also as a cross-linked network which presents an additional free energy term dependent on the total volume of the resin phase has also been developed in detail for the Li-Na exchange system. The systems LiCl-LiR and NaCl-NaR do not obey the Harned rule; both α and β terms are needed to represent the observed interactions. Resinate-electrolyte interactions were found to be approximately 10 times those for similar electrolytes. Equilibration of resin with various molalities of electrolyte followed by isopiestic equilibration with various water activities enable the requisite condition of variation of mole fraction of electrolyte at a given total internal molality to be satisfied. Electrolyte uptake and water content as a function of external molality and temperature were also determined. Previously unobtainable activity coefficients of the pure resinate were estimated by use of this approach. This type of approach was not applied to the zeolite exchanger because the pressure-volume correction term is presently unobtainable. The selectivity was studied as a function of temperature to evaluate the functions ΔH and ΔS in an attempt to extrapolate to exchange behavior in the fused salts. The corresponding modified thermodynamic functions involving aqueous phase activity coefficients were calculated from this data also. In all cases, except at an external molality of 0.1, the modified entropy of exchange, $\Delta S'$, was positive.

Microfilm \$2.75; Xerox \$7.60. 162 pages.

SOLID STATE POLYMERIZATION OF
UNSATURATED CARBOXYLIC ACIDS AND
THEIR ALKALI SALTS

(Order No. Mic 61-1049)

Isaac D. Rubin, Ph.D.
Polytechnic Institute of Brooklyn, 1961

Adviser: Herbert Morawetz

Polymerization in the solid state may be initiated conveniently by ionizing radiation. Many of the early conclusions based on kinetics applicable to polymerization of liquids were invalidated by the observation that the polymerization may continue for long periods of time after removal of the monomer from the irradiation source. This investigation was concentrated on the polymerization characteristics of monomeric acids and their ionic salts, irradiated by Co^{60} at -78° and subsequently polymerized at temperatures ranging from 0° to 160° .

It was found that the crystalline structure plays a significant role in the ease of polymerization of various closely related monomers. Thus, while butadiene-1-carboxylic acid polymerized spontaneously on standing at room temperature, its sodium, potassium and barium salts polymerized only negligibly even when irradiated with gamma rays and heated at high temperatures. Irradiated samples of potassium and rubidium acrylates polymerized readily at room temperature. Lithium and

sodium acrylates, on the other hand, and sodium and potassium methacrylates had to be heated to above 100° to obtain appreciable polymer yields. Lithium methacrylate did not polymerize even at 160° . A previously unreported complex salt, potassium acid methacrylate, was found to polymerize readily at 150° . Irradiated ammonium acrylate and ammonium methacrylate decomposed upon heating. Several monomers, including among others α -chloroacrylic acid, acryloyl glycine, d-acryloyl alanine and N-isopropyl acrylamide, which are known to polymerize readily in solution, either did not polymerize at all or polymerized only to a negligible extent in the solid state upon gamma-ray irradiation.

The polymerization rates of irradiated acrylate salts decayed rapidly at low conversion but the polymer yield increased continuously with time without reaching a limiting value. The kinetics of the process were studied over a range of temperatures for lithium, sodium and potassium acrylates. It was found that the efficiency of the initiation process falls off with an increase of the irradiation dose. The polymerization of sodium methacrylate was preceded by a clearly defined induction period and an initial acceleration of the reaction was also observed with potassium methacrylate.

Molecular weights of the polymerized acrylate salts were determined by light scattering. It was found that the molecular weights of the polymers were constant and independent of polymer yield in each kinetic run. Increase in polymerization temperature of potassium acrylate irradiated with a dose of 2×10^5 rads from 0° to 100° reduced the polymer molecular weights from over 3×10^5 to about 1.7×10^5 ; increase in dose from 2×10^5 to 8×10^5 rads reduced the molecular weight of polymers formed at 25° from about 2.6×10^5 to 1.6×10^5 . Lithium and sodium acrylates yielded polymers whose molecular weights did not exceed 5×10^4 .

Nuclear magnetic resonance measurements on poly-(methyl methacrylate) prepared by polymerizing methacrylic acid in the solid state and methylating the product showed that the polymer prepared in the solid state is less stereoregulated than similar polymers prepared in the liquid state.

Electron paramagnetic resonance measurements on irradiated and also partially polymerized monomer samples indicated the presence of stable free radicals. Irradiated potassium acrylate and sodium methacrylate gave identical three peak signals while the spectrum of irradiated sodium acrylate was somewhat different. Heating the irradiated potassium acrylate at 100° transformed the three peak spectrum to a single peak spectrum; the spectra of the other salts changed little upon heating.

It is felt that the results of the present study reinforce previous indications that the geometry of the crystal lattice of the monomer is of decisive importance in solid state polymerizations.

Microfilm \$2.75; Xerox \$5.40. 108 pages.

**THE PHOTOGALVANIC EFFECT
OF DYE-REDUCING AGENT SOLUTIONS**

(Order No. Mic 61-1050)

Elihu Alan Schatz, Ph.D.
Polytechnic Institute of Brooklyn, 1961

Adviser: Gerald Oster

The photogalvanic effect of dye-reducing agent solutions was studied for numerous systems. This involved the measurement of the potential change of a cell containing, e.g., a platinum electrode immersed in a deaerated aqueous solution of both a photoreducible dye and a reducing agent for the light-excited state of the dye. Among the dyes used were members of the acridine, azine, thiazine, oxazine, and fluorescein families. Reducing agents used were ascorbic acid, allyl thiourea, cysteine and chelating agents such as ethylenediaminetetraacetic acid (EDTA) and triethanolamine (TEA).

Proflavine-ascorbic acid and phenosafranine-EDTA solutions, in particular, were studied in detail. Such factors as light intensity, ionic strength, pH, dye concentration and reducing agent concentration affect the photoreduction and photopotential. The rate of photoreduction corresponds to the rate of change of potential for phenosafranine-EDTA solutions, but this is not the case for proflavine-ascorbic acid solutions.

An outline of the mechanism for the potential change is presented. The final potential achieved for numerous dyes, after complete fading, depends on the standard reduction potentials of the dye-leuco dye system. It is shown to be possible to obtain standard reduction potentials of any photoreducible dye by measuring simultaneously the final potential and the percent transmission of the solution after complete fading. The initial dark potential is thermodynamically irreversible and depends on the reducing

agent when ascorbic acid is used, and is an unstable potential depending on the medium when EDTA is used as the reducing agent. A slow step, which may be diffusion or electron transfer, occurs in the photogalvanic effect. Potential changes as high as 860 mv. have been obtained using phenosafranine-EDTA solutions, and the quantum yield of fading for these solutions is as high as 0.1.

The current that can be drawn from photofaded phenosafranine-EDTA solutions is limited by both the dye and the salt concentrations. When much salt is present, i.e., when the resistance of the solution is sufficiently low, the current is linearly related to the leuco dye concentration. There is evidence that the current originates from the oxidation of the leuco dye at the electrode. Current as large as 0.3 millamps has been drawn, and larger currents can be easily obtained by using higher dye concentrations and cells with lower resistance. By drawing current for sufficiently long times, the number of electrons involved in the oxidation of the leuco dye can be ascertained; and by illuminating the solution during the drawing of current, the number of electrons involved in the oxidation of the reducing agent can be determined. It was established that EDTA and other chelating agents undergo a one electron change for each tertiary nitrogen atom in the molecule.

In the dark the faded phenosafranine-EDTA and proflavine-ascorbic acid solutions slowly form the colored dye again. This is believed to be due to the oxidation of the leuco dye by trace amounts of oxygen rather than to the reaction of the leuco dye with the oxidized reducing agent. Direct conversion of solar energy to electricity without consumption of chemicals may be possible by connecting two photocells together and alternately illuminating them. If oxygen is completely removed from the cell, it is possible for the photoproducts to store the light energy until the system is ready for use.

Microfilm \$2.75; Xerox \$8.60. 186 pages.

ECONOMICS

ECONOMICS, GENERAL

ESTIMATING VITAL RATES FROM PECULIAR AND INADEQUATE AGE DISTRIBUTIONS (SUDANESE EXPERIENCE)

(Order No. Mic 61-1994)

Karol Jozef Krótki, Ph.D.
Princeton University, 1960

The core of the thesis is the application of the principles of the stable population theory to more than a hundred Sudanese populations (old Anglo-Egyptian Sudan). In view of the fragmentary and uncertain information available about these populations it is the quasi-stable extension of the theory, which enables most conclusions to be drawn. One or two even more simplified techniques are used (e.g., the graphical method).

The analysis proceeds simultaneously at three levels: the basis of the approach is theoretical but with a constant eye to the empirical populations; at the same time the methodology of census taking is considered and the possibility is kept all the time open that at least some of the characteristics of the populations are not real, but freaks of enumeration and recording. The variety of techniques used and the simultaneity of approaches is a device to ensure checks and counter-checks at each and every step in view of the peculiarity of the available data: one census only; chronological age distributions for youngest children only; at older ages distribution in terms of male puberty, female puberty and menopause; no registration of vital events, but some vital rates available from recollection; extreme heterogeneity of the populations. (Sampling variability is not a handicap. Any inconvenience appears to be more than counter-balanced by the high consistency of the data.)

The essence of the theoretical approach is that the extreme youth of most of the populations proves very high fertility. The thesis is less sanguine about mortality. In line with findings of recent research, where the unimportance of the influence of mortality on the age distribution is proved, a range of mortalities can be shown to be consistent with the available age distributions. It is however possible to narrow the range by bringing in from outside the theoretical system a series of historical growth rates. The conclusions presented can not be treated with certainty. Nor are the results completely negative. They do throw considerable light on the populations employed as a background for the inquiry.

Among the substantive findings the most important is the high fertility, but equally startling - even to somebody with an intimate knowledge of the area - is the great differential between the more African populations and the more Arabic populations, the former being the more fertile. A parallel differential is found in mortality, the Africans again having higher mortality. This results in moderate growth rates for the more African populations

and high growth rates for the more Arabic populations. The main findings are supported or qualified by a host of considerations, sometimes only indirectly related topics like: migration, polygamy, nomadism, twinning, etc.

In the methodological field the main topic was the suspicion that in the endeavour not to miss children (a traditional failing of probably all censuses) too many were found. But the tiptoeing between the Scylla of obtaining unjustified findings in the substantive field and the Charybdis of accepting biased and erroneous information as correct extended over other aspects. In fact with one or two exceptions nearly every differential could be logically treated as a real finding or as an enumerative bias, even if in the process common sense and credulity in the possibility of field biases would have to be stretched beyond the breaking point.

Microfilm \$5.95; Xerox \$21.20. 468 pages.

HOUSING EXPENDITURE ANALYSIS: A DECISION UNIT MODEL.

(Order No. 61-2968)

Tong Hun Lee, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Guy H. Orcutt

Most research workers in housing have focused attention on explaining aggregate behavior. They have tended to concentrate on statistical analysis, and on the construction of econometric models of aggregate housing demand. However, it is being increasingly realized that many relevant differences among households -- e.g., age of head, marital status, occupation of head, community type -- ought to be considered in conjunction with the conventional economic variables in studying the demand for housing. An analysis of cross-section data can provide this type of information about individual demand for housing; however, only fragmentary work has so far been done along these lines. In this thesis, a cross-section analysis using economic and demographic characteristics is carried out to investigate the determinants of several aspects of the demand for housing.

Data for the computations reported in the thesis were taken from the 1957 and 1958 Survey of Consumer Finances conducted by the Survey Research Center of the University of Michigan, in cooperation with the Board of Governors of the Federal Reserve System.

Single-equation, least-squares regression techniques were used in estimating relationships, and t-tests were performed on estimated regression coefficients. However, in those cases where several regression coefficients represented an effect of one concrete variable, the group of coefficients was tested jointly by an F-test. This study

differs from other works done in this field mainly in that it treats house purchase and new mortgage procurement as jointly distributed. The marginal and conditional distributions of these behavioral aspects in the demand for housing were then investigated.

Major findings are summarized below:

(1) The decisions to own a house or to live in rental housing depend upon common factors, such as disposable income, age of head, marital status, size of unit, occupation of head, race of head, community type, and region.

(2) Surprisingly, disposable income is not a factor in the decision either to buy a house or to move into rental housing.

(3) Income change, rather than level of income, shows some relation to the decision to move into rental housing. The effect, interestingly enough, is negative. Some demographic variables -- age of head, marital status, size of unit, etc. -- are also important in predicting the probability of moving into rental housing.

(4) For a house buyer, disposable income and age of head are the significant determinants of the cost of the house he will purchase and the probability of his incurring mortgage debt. The size of the new mortgage debt can be predicted by initial home ownership and the cost of the house, in addition to disposable income and age of head.

(5) Among house buyers, the size of new mortgage debt is negatively related to disposable income and positively related to the cost of the house.

(6) There is a distinct difference in the size of rent payments between "movers" and "non-movers." For non-movers, rent is higher when the head is a woman than when the head is a man, but the sex of the head does not seem to make any difference among the movers. In addition, there are notable differences in the effects on rent of such variables as disposable income and size of unit.

(7) The study suggests that community type and regional differences are more helpful in explaining housing behavior than they are in explaining other areas of consumer behavior.

Microfilm \$2.75; Xerox \$6.80. 143 pages.

EFFECTS OF INFLATION UPON THE INCOMES AND ASSET VALUES OF CONSUMER SPENDING UNITS, 1949-1958.

(Order No. Mic 61-2778)

Herbert Edward Neil, Jr., Ph.D.
University of Michigan, 1961

This study is designed to measure the effects of a slowly rising price level, or "creeping inflation," upon the financial positions of different groups in the population of the United States. An attempt is made to identify the relative gainers and losers on income and asset account between 1949 and 1958, during which time the Consumer Price Index rose 21 per cent, or slightly over 2 per cent per year.

The population is divided into groups which are homogeneous with respect to occupation, age, and in some cases education of the principal income receiver in each consumer spending unit. These three characteristics are closely related to the income of the spending unit and

through past income to the size of asset holdings. Mean incomes of identical groups are analyzed for the 1949-1958 period in order to measure income trends. The effect of inflation upon income changes is estimated for each group after assigning quantitative values to those non-inflationary factors which influence income. The 1953 balance sheets of spending units are utilized in studying the impact of inflation upon the value of assets. Appropriate price indexes are constructed for each type of asset, and then applied to the 1953 assets to arrive at a change in value of net worth between 1949 and 1953. The distribution of these capital gains among the various occupation and age groups is analyzed. To obtain a single measure of the inflationary effects of 1949-1958, income changes attributable to the rising price level and capital gains for each of the groups are combined. Several approaches to the problem of adding effects of inflation upon income and asset accounts are explored.

The empirical results suggest that younger spending units in a majority of the occupations have been relative gainers from the inflation of the period through a rapid rate of increase in their incomes. A debtor status has also benefitted the spending units headed by young adults. Among the occupational groups, the largest dollar gains associated with the inflation have been received by self-employed businessmen. Large capital gains have accrued to these entrepreneurs because of their sizeable asset holdings. Relative gainers between 1949 and 1958 were the clerical-sales and skilled and semi-skilled occupations. Both groups increased their incomes at above-average rates. Spending units headed by older clerical and sales workers achieved substantially larger increases in income than did other groups in these age classes. Farmers have benefitted on asset account because of their extensive ownership of farmland, the price of which rose 49 per cent between 1949 and 1958. The two occupations with the lowest incomes, unskilled-service and retired, have been relative losers during the inflationary period. Incomes increased slowly for both these occupational groups. The unskilled, moreover, held relatively few assets upon which capital gains could be received.

The findings of this study indicate that the inflation of the 1949-1958 period has had diverse effects upon the financial positions of various groups in the population. The size and direction of the redistributive effects of inflation lend support to public policies which would correct the inequities caused by a rising price level.

Microfilm \$3.15; Xerox \$11.05. 243 pages.

LABOR RELATIONS IN THE TELEPHONE INDUSTRY: A COMPARISON OF THE PRIVATE AND THE PUBLIC SEGMENTS.

(Order No. 61-2988)

James Earl Williams, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Edwin Young

The Problem

The problem was to investigate labor relations in the telephone industry in order to determine if the superior

level existed in the private or the public industry; that is, in which segment of the industry Labor fared best. Closely related was the problem of determining the characteristics which account for the differences in the level of labor relations and whether or not ownership *per se* was an important determining factor.

Procedure

The United States industry, which is the major private telephone industry in the world, was chosen as the private industry to study. Each of the Canadian prairie provinces of Manitoba, Saskatchewan, and Alberta has a publicly-owned telephone system. The similarities between the United States and Canada in regard to history, sociology, economic and political environment, in addition to the fact that the same telephone unions existed in both countries, made the public industry in Canada a logical choice for a comparative analysis. Further, in order to test the importance of similar geography, a case study area was established which included Minnesota, North Dakota, South Dakota, Iowa, and Nebraska. This is the area covered by the Northwestern Bell Telephone Company and a number of independent companies.

Once the area of analysis was determined, the history of the private and public telephone companies was traced. This was followed by the historical development of the telephone unions existing in the two nations. The comparative analysis of labor relations in the two segments of the industry was undertaken through the development of a group of areas for examination; to the extent possible, the same areas were examined in each industry.

The United States analysis was centered around the Bell Telephone System. Environmental factors were examined first. These included inherent, union-influenced, and management-influenced environmental factors. Once the environment had been analyzed, the collective bargaining process was investigated, followed by an intensive study of the strike and the day-to-day relationship existing in the industry. The research was completed by a thorough examination of wages and fringe benefits. The wage study included historical and current comparisons of averages, rates, and ranks, as well as a study of wage determination. Similarly, the trend and ranking of the industry in relation to the major fringe benefits were ascertained. The factors tested for the analysis of the public industry were almost identical to those used in the private. The major difference was that much more emphasis was placed on the role of government as a management-influenced factor and the importance of union access to government in the collective bargaining process. A comparison of the results of the analyses of the private and public segments of the industry led to the conclusions of the study.

Results and Conclusions

Private or public ownership *per se* had little, if any, real effect on the ultimate level of labor relations in the telephone industry. It is the total inclination of a number of factors which determines whether the ultimate level of labor relations will be positive or negative. The major factors influencing labor relations follow:

1. The philosophy and attitude of government.
2. Union access to government.
3. Size of the company.
4. Degree of autonomy exercised by the parties.
5. Ability to pay.
6. Management attitude toward the union as an organization.
7. Mutual security of the parties.
8. The degree of independent unionism, non-unionism, and rival unionism.
9. Degree of union democracy.
10. Age of the collective bargaining relationship.
11. Geographical area of the relationship.
12. Attitude toward contract administration.
13. Degree of effectiveness and kind of strikes.
14. Wage trends and administration.
15. Rank and trend of fringe benefits.

Microfilm \$7.15; Xerox \$25.45. 564 pages.

AN APPROACH TO THE PROBLEM OF MEASURING UPGRADING DEMAND IN THE HOUSING MARKET

(Order No. Mic 61-2807)

Alan Richard Winger, Ph.D.
University of Michigan, 1961

This thesis is concerned with the problem of measuring housing demand that arises from efforts to upgrade housing standards. The major objective is to develop a means of measuring this aspect of housing demand. The focus is on the housing space (number of rooms per family) and housing quality (house values and rents) holdings of "equilibrium" families (do not have plans to buy or make a major addition and have changed residence recently) from a cross section of the population. The fundamental hypothesis is that a demand equation calculated from data for equilibrium families provides the means for estimating upgrading demand in the housing market. The basic argument is that the families who adjust to upgrade housing standards have a deficiency in housing which will be reflected in a comparison of the demand calculated from this equation and the amount of housing these families have.

These housing "norms" are calculated in the first stage of the analysis. Variations in the behavior of equilibrium families are incorporated into the "norms" by splitting the sample into more homogeneous groups and calculating separate income-housing regressions for each. The analysis of covariance is used to determine in which classes there are significant differences. These tests not only provide the basis for subdividing the sample, but also the basis for a discussion of the cross section relationships

between family housing and the economic, demographic, and sociological factors included in the analysis.

The hypothesis is then examined in two ways. First, since the success of this approach depends on the presence of measurable differences between those families in and out of adjustment, the housing of equilibrium families (see above) is compared with that of disequilibrium families (have plans to buy or make a major addition and have not moved recently). Second, the predictive value of the house value and rent "norms" is studied. These regressions are used to calculate housing demand for families from another sample, and these expected values are compared with the actual housing.

The analysis of the cross section relationships shows that housing space holdings of equilibrium families are a function of income, life cycle, home ownership status, occupation, education, and region. Of these, life cycle is the most important. Home investment of equilibrium families is found to be a function of income, education, occupation, city size, life cycle, and region. Income is the most important of these and also accounts for much of the variation in rent payments of equilibrium families.

With respect to the housing space "norms," our findings indicate that in those life cycle stages in which the likelihood of a housing space shortage is greatest (family size is increasing or at a maximum) disequilibrium families have significantly less space than those in adjustment. Our findings also show that those home owning families who are out of adjustment with respect to the quality of their housing have significantly less housing in terms of house values than equilibrium families. Our study of the predictive value of the house value equations adds further support to our hypothesis that they can be used to forecast upgrading demand, although our tests indicate that they provide estimates of potential rather than actual demand. The equations worked in that when "applied" to families in another sample, those families who were out of adjustment (plans to buy and had not moved recently) were shown to have a greater deficiency in housing than those in equilibrium. The tests of the rent regressions show they would be of little use in predicting upgrading demand among renters.

Microfilm \$2.75; Xerox \$8.20. 176 pages.

ECONOMICS, AGRICULTURAL

MAJOR ECONOMIC IMPACTS OF THE CONSERVATION RESERVE ON OHIO AGRICULTURAL AND RURAL COMMUNITIES

(Order No. Mic 61-2818)

Wallace Barr, Jr., Ph.D.
The Ohio State University, 1961

The build-up of surplus farm commodities in government storage, the rising costs of production, and the low net farm incomes are symptoms of the farm problem. Output increases come quickly. Demand for agricultural commodities increases primarily with growth in population. Land, labor, capital, and management resources de-

voted to farming produce a high level of output; demand is inelastic. As a result, incomes from farm resources are below those of the non-farm segment. The inadequate mobility of resources devoted to agriculture restricts adjustment.

The Conservation Reserve program, a part of the Soil Bank Act of 1956, is a long-term voluntary program designed to reduce production, improve farm incomes, and increase conservation. Participants agreed to establish conservation cover, control noxious weeds, harvest no crop, and not to pasture cropland.

The general objective of this study was to measure the program impact in Ohio. Specific objectives were to determine the degree of attainment of program objectives, the type of operation enrolled, the impact on various segments of the local economy, and the effects on agricultural resources. Primary data came from a survey conducted on 120 participating farms in three Ohio counties. Secondary data from many sources were used.

Most farmers participating enrolled all their cropland. In Ohio, annual compensation averaged \$17.21 per acre in 1960. Participating farms averaged 61.0 cropland acres. Cropland acres per farm enrolled in the Corn Belt area were significantly smaller, while those in the hilly area were significantly larger than non-participating farms in these areas. Participants had significantly more Class III and IV land than did non-participants.

Over 50 per cent of the participants mentioned health and retirement, improved or assured income, and opportunity to improve soil as reasons for participation. Many expressed extreme difficulty in keeping up with progress. Older farmers frequently gave retirement as their reason for participation. Part-time farmers participating usually first secured off-farm employment. In general, the program has stimulated the mobility of people out of active farm operation. A small amount of permanent land use adjustment was initiated. The program should eventually contribute to more rapid farm consolidation.

In Ohio 4.3 per cent of the cropland was enrolled by 1960. It is estimated that the production of corn, soybeans, wheat, and oats would have been 3.1 to 3.4 per cent greater in Ohio in 1960 if the program had not been in effect, and that all of the crop would have gone into government storage or the prices of grain commodities would now be lower. Probably part would have gone into storage and the remainder to market or to livestock on farms, bringing some depressing effect on both crop and livestock prices and also increasing government storage costs.

In most Ohio communities, farm marketing agencies had their potential volume of business slightly reduced. The extent varied according to the proportion of land enrolled in the area and the proportion of total business normally done with participants. Because of the inelasticity of the demand for food, we can expect that the total cash farm receipts of non-participants increased. Purchases of goods and services for production by participants declined less than did farm marketings. Taxes, insurance, and interest on real estate loans continued practically unchanged.

The average net farm income of those enrolled declined after participation. However, increased income from other sources more than offset the decline. Since increased family income is likely to bring increased expenditures for consumer goods, Ohio sales tax collections

should increase. Federal income, excise, and luxury taxes also are expected to increase slightly.

Microfilm \$4.40; Xerox \$15.55. 342 pages.

METHODS OF ECONOMIC EVALUATION OF OUTDOOR RECREATIONAL USE OF WATER AND A CASE STUDY OF THEIR APPLICATION

(Order No. 61-2953)

Glen Dale Fulcher, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor C. W. Loomer

Problem

Recreation has become an important use of our water resources. Expected future increase in population and amount of leisure time will increase demand for recreational use of water. Insufficient consideration has been given to economic evaluation of recreational use of water compared to other alternative uses. Methods for effective economic analysis of recreational values are needed to aid in evaluating recreation if this important use is to be properly evaluated in relation to other water uses.

Methods of Analysis

An analysis was made of various methods that might be used in economic evaluation of recreation. The methods were analyzed in relation to their usefulness for application under various types of ownership.

Water use on Pyramid Lake Indian Reservation in western Nevada was selected for a case study of the applicability of economic methods of recreational evaluation. The Indians face the problem of how to utilize their limited supply of decreed water. Their alternatives are to use the water for increased agricultural development or for a fishway to restore the fish population in Pyramid Lake. An economic analysis of these two alternatives was made.

Basic data on the expenditures on fishing were determined from a survey of approximately 18 percent of the fishermen using the lake during a fishing season. Data from the survey were used in computing expected increased return from using decreed water for further improvement of fishing compared to expanding agriculture.

Evaluation of expected additional income from agriculture was determined by aggregating net returns from budgets and leases.

Findings

The profit maximization model has considerable application in evaluation of privately owned recreational resources. The model, however, has little application in evaluation of publicly owned recreational resources where maximum social welfare rather than profit is the goal. Institutions and different value systems limit use of the profit maximization method in evaluating recreational resources held in quasi-private ownership (tribal ownership).

Under the institutional agreements that exist on the Reservation and the assumptions used in the study, agri-

culture should provide a larger income than a fishway. However, agricultural products have a market price while many values from fishing do not. Use of economic models in recreational evaluation underevaluate the real value of a recreational resource because of the difficulty in placing a price on the intangible values of recreation. Most economic models that have been used in recreational evaluation ignore intangible benefits and concentrate on benefits (mostly secondary) that can be measured in monetary terms.

Conclusions

Conventional economic methods of resource evaluation have limited application in evaluating publicly owned recreational resources. Social values--public schools, national defense, public recreation, etc.--are subjective values that are difficult, if not impossible, to evaluate in monetary terms. More research is needed in the economics of recreational evaluation to develop methods of determining and evaluating intangible values.

The Pyramid Lake Indians should use their limited water supply in the resource development that promises to provide them with the greatest income. If the people of Nevada want a fishery development, they must be willing to assure the Indians an income from fishing equal to or greater than the expected income from agriculture.

Legislators and public administrators need the best possible physical, sociological, psychological, and economic information available on recreational evaluation to aid them in making decisions on the value of outdoor recreation. This information can best be obtained through the combined efforts of researchers in these various disciplines. Although economics does not yet provide the means for quantifying all the values involved, economic evaluations properly used can still make a valuable contribution for decision making on the importance of outdoor recreation to society.

Microfilm \$2.75; Xerox \$6.40. 133 pages.

A MINIMUM COST MOVEMENT PATTERN FOR FEED GRAINS IN OHIO

(Order No. Mic 61-2828)

Cecil Eugene Fuller, Ph.D.
The Ohio State University, 1961

The additional cost of moving grain, into and within a state, that has moved out of position in the market channel relative to demand may add to the cost of grain to purchasers or may be reflected in increased operating costs to grain-handling firms. This problem appears to be one of economic consequences that has a depressing effect upon the economic welfare of the agricultural industry.

With the introduction and adoption of new tools for harvest, the time involved in harvesting grains has been reduced. Harvesting grains with moisture content that makes them unsafe for normal farm storage has led farmers to place grain in commercial market channels, either for storage or for early sale. In normal operations assembly firms move this grain to other points, terminal and terminal-processing firms, in the market channel.

Consequently, as the feeding year progresses, supplies of local grains may be out of position, and the demand for feed grains must be satisfied with supplies from other areas or the out-of-position grain moved back.

It was thought that if the supply and demand picture for feed grains could be described and a minimum cost movement pattern developed, savings would result that might motivate planning by firms in the state to adjust to the described pattern. This adjustment should enhance the economic well-being of the agricultural industry of the state.

The demand for feed grains in each county of the state was estimated for the average number of animals fed each year by the application of commonly accepted rations. The supply of feed grains produced was estimated and the difference of the volume of supply and demand was used to determine the surplus or deficit position for each county.

To facilitate handling the problem by hand calculation, study areas were described. Eleven areas (adjacent counties) were selected, following closely current crop-reporting and freight rate district lines. These areas were described as being surplus or deficit according to total supply and demand exhibited by the included counties.

Since most hauls involved relatively short distances, it was assumed that truck rates would afford a solution to the problem with minimum costs. Current rates per bushel for trucking grain were used and adjusted to account for variations in price that are reflected by freight rate differentials.

These data were then assembled into a tableau for linear programming. Corn and oats were programmed separately, with a resulting pattern of movement of grain from areas of surplus to areas of deficit at a minimum cost.

Ohio is a surplus producer of corn. There were three areas in Southeastern Ohio that were deficit, requiring 3,639,000 bushels more corn than was produced within these areas. The remaining eight areas were surplus by 25,226,000 bushels. After satisfying the demand of deficit areas, 21,587,000 bushels must be moved into storage or to markets outside the state.

Oat production was in surplus in three areas of the state (west and northwest), with the remainder being deficit by over 23,000,000 bushels. Feeders and grain firms in Ohio then must find an additional supply of 13,492,000 bushels of oats.

The study definitely defined the surplus and deficit grain-producing areas of Ohio by county. Linear programming provided a description of a movement pattern that would provide local grain to Ohio feeders at a minimum cost.

The use of a computer would allow solution of the problem on a county basis. Such a solution should result in even greater savings in transportation costs.

Microfilm \$2.75; Xerox \$7.00. 147 pages.

AN ECONOMIC ANALYSIS OF CONSUMER SHOPPING PATTERNS IN FIVE DAYTON, OHIO, SUPERMARKETS.

(Order No. Mic 61-2830)

Harry Greenbaum, Ph.D.
The Ohio State University, 1961

The modern supermarket has a high volume of sales, low gross margins, and low net profits per dollar of sales. The maximization of efficiency is, therefore, of paramount importance to supermarket managers.

Better information about shopping -- time of day, day of the week, during the various holidays, and through the passage of time -- can be used by supermarkets to improve their efficiency of operation in a number of ways.

In this study, five sample stores were analyzed. Factors affecting the volume of sales, such as weather conditions, seasonal effects, pay periods, advertising expenses, and general economic conditions, were considered.

It was found that check-out counters were understaffed during certain hours on some days of the week and overstaffed during others. During the first five business days of the week (Monday to Friday), peak sales generally occurred between four and seven p.m. During these hours, check-out problems were usually greatest.

Sales in all five stores were heaviest on Friday and Saturday. There were, however, many differences among the five stores with regard to the percentage of sales taking place during the various days of the week. Differences were also noted between weeks during which a major holiday occurred and weeks during which there were no holidays, with respect to the distribution of weekly sales by day of the week.

An index of the volume of weekly sales was examined for a four-year period. Not only the over-all trend but also the factors listed in the third paragraph of this abstract were considered.

In view of differences among neighborhoods, among communities, and among various periods of time, these patterns need to be investigated under the specific conditions in which they occur. It is hoped that the methodology developed in this study will be beneficial to others who desire to obtain better information about shopping patterns in retail food merchandising.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

A COMPARATIVE ANALYSIS OF CORN PROBLEMS AND PROGRAMS IN THE UNITED STATES AND THE UNION OF SOUTH AFRICA

(Order No. Mic 61-2713)

Andries Petrus Scholtz, Ph.D.
Michigan State University, 1961

Major Professor: Victor E. Smith

The corn industry in South Africa has experienced considerable growth since 1949/50. The situation has changed from one of impending shortages to one of perennial surpluses that have to be exported at a loss. The current government program to stabilize the corn industry was

instituted during times of shortages and has remained basically unchanged despite the marked change in the actual situation. This has not encouraged an adjustment between supply and demand. Since the United States also has been experiencing problems with corn surpluses, it was felt that a comparison of the problems and programs for corn in the two countries perhaps would provide useful pointers for future policy in South Africa.

The approach followed was to examine in detail the underlying factors, which have led to the current situation in South Africa. Delays in the publication of Census data have proved a limiting factor in this investigation. The programs evolved in South Africa and the United States, respectively, were then described and evaluated. Finally the experience of the two countries was compared and the relative merits of the main props in their programs examined.

An examination of the South African situation shows that the increase in corn production was the result of technological advances aided by favourable price levels for corn and increased stability of corn prices. The chances of an increase in domestic consumption in the short run are small, but increased use of corn as animal feed holds some promise for the long run.

The Board's price policy has not aimed at bringing supply into line with domestic demand. The current situation requires a reconsideration of the Board's price policy as well as the basic form of control. More attention will have to be paid to stabilizing incomes, since increased mechanization has increased farmers' needs for minimum levels of cash returns.

An evaluation of the price support program in the United States reveals the following: that equity of income distribution within agriculture has not been improved; that agriculture's share of the total income has been prevented from falling off as rapidly as would otherwise have happened; that effective supply control is essential if support levels are high, but this has been impossible to achieve in practice. Price support programs should be designed to encourage adjustment between supply and demand, but they cannot be expected by themselves to bring about an adjustment of the magnitude required in present circumstances.

In South Africa it is not clear whether the main problem is connected with the allocation of resources between agriculture and the rest of the economy or with the allocation of resources within agriculture. The latter type of adjustment falls more within the scope of the price mechanism, and the Board therefore needs to reappraise its price policy. A less comprehensive form of control seems to be advisable; in this respect a floor price system such as in the United States holds promise. The Board also should take a more definite stand with respect to the increased surplus production of corn. Not only should the producers' levy be employed as a signal for production, but the gross producers' price should reflect the adjustment in supply desired by the Board. If prices are to be maintained above the level justified by local conditions relative to world prices, effective control over supply would become a necessity. The United States' experience clearly shows that acreage control is impractical and control over the quantity marketed seems to be the only alternative with a chance of success.

Microfilm \$3.15; Xerox \$11.05. 242 pages.

PRIVATE DEVELOPMENT, UTILIZATION AND EVALUATION OF RECREATION RESOURCES IN NORTHERN WISCONSIN.

(Order No. 61-2985)

Richard George Walsh, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor C. W. Loomer

The northern lakes country is dependent on recreation development as one of the chief uses of its natural resources. The objective of this study is to describe and to analyze the factors that affect recreation land development and use in selected lake areas, to determine recent trends, and to obtain some opinions of recreation landowners concerning emerging problems. The geographic units of analyses are lake areas, each with competing groups of summer cottage, rural residence, resort and youth camp owners. The two areas studied are Crescent Lake, six miles west of Rhinelander, county seat of Oneida County, and South Twin Lake, 10 miles northeast of Eagle River, county seat of Vilas County, Wisconsin. They are, on the whole, typical of hundreds of small lakes in the region. With nearly all of the land in private ownership, the kind and quality of land development and use is controlled largely by private landowners.

Data for the study were obtained by personal interview with 136 recreation landowners, by field investigation of 179 private recreation tracts, and from secondary sources on 219 recreation units in the two lake areas.

While one-fourth of the recreation property owners are retired, most are middle aged, with no small children and few teenagers at home. Moderate to low income people are not excluded from lakeshore ownership. Most owners of summer cottages have permanent residence in Wisconsin, while most patrons of commercial resorts and youth camps come from outside the state, the largest proportion from the Chicago metropolitan area. Guests are frequently entertained, often relatives who bring the entire family. Nine out of ten people using recreation property during the year are guests and more than half are children.

Since the early recreation development of the 1920's new construction has proceeded at a rapid rate. Numbers of lakeshore dwellings have increased by 25 percent on South Twin Lake and 50 percent on Crescent Lake within the last decade. Among factors influencing development are: physical characteristics of sites, friends and relatives, the opportunity it provides for self-employment, and the construction of new highways for convenient tourist access and permanent rural residence.

Total annual land and water use for recreation has more than doubled since World War II. This reflects increased population, more landowners, more guests and more children, as total average per capita utilization remains about the same. The quantity and quality of all recreation land and water use is influenced by the introduction in the 1950's of large outboard motors and water skiing. One-third report a decline in fishing and an increase in water sports of swimming, pleasure boating and water skiing. Today, more than three-fourths of the estimated total recreation use of the lakes is for water sports, with over half for swimming, and less than one-fourth for fishing. Even resorts report most of their guests are families who come for vacation, for rest and for water sports, not primarily for fishing.

Principles of resource use often exhibit considerable variation and frequently are in conflict. Differences between individual preferences and uses give rise to unplanned, inconsistent and heterogeneous lake communities. This is illustrated with data on lot size, frontage, building values, improvements, setbacks, buffer zones, and locations of conflicting land use.

Evidence obtained in this study has some important implications for alternative policy proposals. Some conflicts may be reduced by changes in statutory laws, while other problems continue to be solved in the courts or by informal agreement. Indications are the alternative to eliminating fishing and rowboating on small lakes is regulation of the over-riding water uses. The possibility of working out arrangements to reduce conflicts between conflicting recreation land uses seems promising. Perhaps lake areas should be classified as primarily rural residence, summer cottage, commercial resort, youth camp, or public parks, with land use plans made accordingly. Additional lake areas, compared with the areas studied, would be useful in answering questions about flexibility in land and water use control.

Microfilm \$2.75; Xerox \$7.80. 166 pages.

ECONOMICS, COMMERCE - BUSINESS

A CRITICAL ANALYSIS OF METHODS OF DETERMINATION AND UTILIZATION OF TERRITORIAL MARKET POTENTIALS

(Order No. Mic 61-2817)

Robert Walter Baeder, Ph.D.
The Ohio State University, 1961

The principal purpose of this study is to appraise critically the methods of determination and utilization of territorial market potentials. An additional purpose is the clarification of the definition of market potential.

The bulk of the data was obtained from a survey of fifty-four individuals representing various divisions of forty business firms which were following an effective program of determining and utilizing territorial market potentials. Additional information was secured from an extensive examination of marketing literature, from research organizations such as the American Management Association, and from individual researchers who have done work in the field of market potential.

Market potential is the total amount of a product that would be sold to customers defined as to type and geographic location, in a definite time period, under a given set of market conditions, assumed or actual. It is divided into two categories for analytical purposes. Developed market potential is the total industry sales of the product in the time period being considered. Undeveloped market potential is the difference, if any, between market potential and developed market potential. Much confusion could be avoided if marketing researchers would place greater effort on defining market potential before undertaking its computation.

Territorial market potentials are used to measure territorial market position, determine sales potentials by territory, determine sales quotas, analyze territorial customer coverage, allocate sales manpower, realign sales territories, and allocate regional advertising appropriations. The study shows that their most important use is the measurement of territorial market position. It was also determined that most of the companies surveyed were not making maximum use of market potential information.

Two basic methods are used to determine territorial market potentials, namely, economic factor and customer census. The economic factor method requires estimation of the relationship between market potential and an economic factor or factors either by statistical correlation or judgment analysis. The estimated relationship is then used with regional economic data to compute potentials by territory. The customer census requires that each customer for the product be identified by geographic area and contacts be made to determine his purchases. Territorial potentials are computed by tabulating the purchase data by territory.

The "correlation approach-economic factor" method appears to provide the most accurate potentials for consumer goods, whereas the customer census is preferred for raw materials and heavy industrial goods. Both of these methods have been used successfully for lighter industrial goods.

The "judgment approach-economic factor" method is used more frequently than correlation even though the latter is more accurate. Usable market potentials can be secured by the application of a judgment approach provided a scientific procedure is adopted. The lack of suitable data, the characteristics of certain markets, time and cost considerations, and the complexity of correlation help to explain why it is not used more widely. More accurate territorial potentials could be obtained if researchers would exercise greater care in the selection of the method of determination.

The method used to determine territorial market potentials must be verified for accuracy before its application can be justified. Several verification tests are available: comparisons with published total potentials, cross checks of individual customer data, comparisons with published potentials obtained by market surveys, and sales managers' opinions of computed potentials. Most of the firms studied used one or more of these tests.

Microfilm \$2.75; Xerox \$9.00. 200 pages.

ACCOUNTING FOR BUSINESS SEPARATIONS

(Order No. Mic 61-2741)

William Hammond Culp, Ph.D.
University of Michigan, 1961

The purpose of this study is to present a statement of the accounting principles and procedures applicable to business separations, the economic opposites of business combinations. This study is composed of two parts. The first part concerns the reasons for undertaking the study while the second part concerns the determination of and illustration of the principles and procedures applicable to business separations.

In the first part of the study, Accounting Research Bulletin No. 48, a statement of the accounting principles and procedures applicable to business combinations, is analyzed and evaluated to determine whether that Bulletin provides a sound basis for inferring the accounting principles and procedures applicable to the accounting for business separations. The evaluation led to a negative conclusion because the Bulletin's principles and procedures were found to be inconsistent with the proprietary concept of the enterprise and only superficially based upon the entity concept of the enterprise. Also in the first part of the study, evidence is presented to indicate that the purpose of this study does not concern a trivial matter. The most convincing evidence is that the motives for these transactions concern practically every significant aspect of business operations.

In the second part of this study, the brief literature on the accounting for business separations is evaluated and found to be lacking in consistent theory, much the same as Bulletin No. 48. To develop a statement based on consistent theory, the approach ostensibly espoused in Bulletin No. 48 is taken as a point of departure and followed rigorously. That is, an attempt is made to interpret business separations by consistently evaluating the economic substance of these transactions in the light of the entity concept of the enterprise. Also, attention is devoted to the meaning of such terms as "a business," "to separate," and "basis of accountability." The principle of interpretation which is developed is that the accounting for a business separation should reflect whether the economic environment of the enterprise divided is substantially changed by the separation. Interpretation according to this principle differentiates intra-environmental separations and inter-environmental separations. The former group does not give rise to a new basis of accountability, meaning that assets transferred need not be restated and related earned surplus may be carried forward. Inter-environmental separations do give rise to new bases of accountability for businesses transferred and comprise the following types of transactions: (1) sale, (2) distribution of earnings in kind, (3) partial liquidation, (4) liquidation and reorganization. Criteria are developed for applying this principle of interpretation.

The development of the criteria indicates that intra-environmental transactions are infrequent occurrences. The investigation of and analysis of cases, as reported in this study, confirms this conclusion.

The study indicates that while procedures based on the rigorous application of theory may not always be practical, procedures based upon practical considerations without regard to theory should be justified by frank admission of their nature and by clear demonstration of the superior value of the practical considerations over sound theory.

Microfilm \$3.95; Xerox \$13.95. 306 pages.

THE NATURE AND FUNCTIONING OF THE ARMY AND AIR FORCE POST EXCHANGE SYSTEM

(Order No. Mic 61-2824)

Alton Frederick Doody, Jr., Ph.D.
The Ohio State University, 1961

The term post or base exchange refers to a complex of retailing activities at a military installation that provides a limited variety of goods and services for personal consumption by servicemen and their dependents. This study analyzes the development and present status of exchanges, particularly as they are operated within the United States by the Army and Air Force. It is organized into three basic sections dealing with (1) the history, organization, and legal status of the exchange system, (2) the place of the exchange in the marketing structure and the manner in which it performs basic marketing functions, and (3) an economic evaluation of exchange operations and an appraisal of those aspects of the system that are most controversial.

Since little is generally known about military exchanges, considerable confusion exists regarding their true nature and significance and regarding the best solution to the many problems confronting them. There was an opportunity, therefore, to clarify this entire area and, on the basis of the analysis, to make suggestions that would serve to improve current exchange operations within their legal and economic context. Among the principal conclusions reached are the following.

The exchange is an essential and integral part of military life. Its legal status, as an instrumentality of the federal government, is well established and has been sanctioned by Congress and the federal courts.

Exchanges generally charge lower prices than do competing private retailing institutions. This is explained not by greater operating efficiency but by the absence of certain classes of operating expense, especially rent, and by a limited-service policy.

The convenience and lower prices afforded by the exchange system are significant factors in building morale, and, hence, the system is regarded by the military as a positive element in maintaining an effective personnel program. For this reason alone, the exchange system is socially desirable and deserves public support.

The operating effectiveness of the exchange system could be substantially improved. The analysis of buying, for example, revealed a need for greater buying specialization, more skilled buying personnel, and a more rational policy to govern the choice of types of suppliers. Among other things, the typical exchange was found to place entirely too much emphasis on direct buying, with the result that wholesale middlemen, often in a position to serve exchanges more advantageously than manufacturers, have not been properly utilized. The analysis of selling indicated that exchanges would benefit from further departmentization, a more flexible approach to pricing, a centrally directed layout and fixture modernization program, and an improved system to handle special orders.

In spite of recurrent criticism by retailing interest groups, the exchange system is not incompatible with our private competitive system. Public policy has long recognized that, under particular circumstances, it is desirable for the government directly to undertake certain

business enterprises. The special needs of the Armed Services require that the exchange be included in this category. Besides, the matter of exchange competition with private retailers has received attention far beyond its economic importance. When carefully analyzed, it was found that the volume of business in possible conflict is only \$100 million a year, an amount which can hardly be considered a significant competitive factor in our retailing system which currently accounts for an annual volume substantially in excess of \$200 billion.

Microfilm \$3.05; Xerox \$10.80. 236 pages.

THE SECONDARY MARKET FOR URBAN RESIDENTIAL MORTGAGES

(Order No. Mic 61-2378)

Oliver Hastings Jones, Ph.D.
The Pennsylvania State University, 1961

For more than thirty years, many proposals to establish a central mortgage bank, or a federal facility under any other label, have been recorded in the history of mortgage finance in the United States. Generally, the proposed facility is expected to overcome inadequacies in the secondary market for urban residential mortgages by endowing mortgages with marketability, providing reasonable stability in the flow of mortgage funds, and moving funds from capital-surplus to capital deficit areas. And yet, an adequate secondary market has not been defined. As a result, the need for a central mortgage bank has not been firmly established or denied. In this study, (1) the performance record of the secondary market is evaluated, (2) recommendations for improving its efficiency are proposed, and (3) the need for a central mortgage bank is established.

As a first step, the secondary market was defined to include only transfers of existing mortgages where the purchaser has not provided a commitment to purchase the mortgage prior to its acquisition by the seller. Although this definition differs from common usage, it distinguishes between primary and secondary market transactions by including in the secondary market only transactions between principals who make separate decisions and take separate risks.

A standard was then formulated for measuring the adequacy of the performance of the secondary market. The standard was drawn from the criteria of a perfectly competitive market in order to obtain a conception of maximum, though not fully attainable, efficiency by abstracting from existing market imperfections and tracing the evolutionary development of an unfettered secondary market within the institutional setting in which it must operate.

The functions of such a market include: (1) providing primary lenders with a means for making portfolio adjustments by "making a market" for mortgages and (2) acquiring and processing mortgages for long-distance lenders. These functions, in turn, provided a basis for anticipating the economic consequences of adequate performance. By focusing the net balance of changes in supply and demand on a single segment of the market--the market makers, prices would be efficiently determined, resource allocation improved, and stability enhanced.

Thus, a standard was obtained to measure the performance of the actual secondary market by comparison. The major findings are:

(1) The secondary market has been thin and erratic; unable to perform adequately.

(2) Portfolio adjustments made through alternative market arrangements in the primary market, including the Federal National Mortgage Association, have failed to generate results comparable to those of an adequate secondary market.

(3) The mortgage market abounds with imperfections that discourage potential market makers by splintering the primary market by type of mortgage, type of lender, and location of property.

Under these conditions, the development of an adequate secondary market will require the removal of man-made barriers that divide the market and constrict the flow of funds. To provide the breadth necessary for a national secondary market, it was recommended that: (1) rates on FHA and VA mortgages be market determined, (2) permissible terms on conventional mortgages be the same for all lenders, and (3) lending area limits be removed for all lenders and for all types of mortgages.

Thus, major reforms are first necessary in the primary market and the central mortgage bank emerges in a supplementary role. It is needed mainly to encourage the development of an adequate secondary market during the period of reform in the primary market. Thus, the major functions of a central mortgage bank would include maintaining an orderly market by buying and selling mortgages at its volition and at going prices. It would also charter and supervise market makers, make short-term advances, and collect and disseminate market information on transactions, prices and terms.

Microfilm \$4.05; Xerox \$14.20. 313 pages.

OBTAINING RETAIL FLOWER SALES

INFORMATION BY MEANS OF AN
"IN-SHOP" SYSTEMATIC SAMPLING METHOD.

(Order No. Mic 61-2707)

Earl Hiram New, Ph.D.
Michigan State University, 1961

Major Professor: Paul R. Krone

Statistical validation of a frequency sampling method became a prerequisite for further retail flower sales investigation in 1957. The sampling method was designed to reduce the tremendous volume of individual sales data that were being collected from 12 selected Michigan flower shops. The validation of the sampling method was imperative for continuing and more efficient and effective study of the effect of alternative managerial decisions and methods on retail florists' business.

To do this a factorial design was used. Records of 50,582 individual retail sales made over a period of seven months in the 12 shops were arranged into 58 categories. They were recorded on mark sense International Business Machine cards, and sampled by three methods.

The methods, based on 10 per cent frequency sampling, were:

(a) "In-Shop" systematic, in which the systematic samples were identified as the population was recorded in the shops.

(b) Stratified random, selected on a 407 IBM machine from the complete deck of cards.

(c) Systematic, selected in the same manner as (b).

Only two of the 58 categories were selected for statistical validation of the sampling method. They were "all retail sales" and "arrangement sales." These two categories were the only ones which provided a wide range of frequency of occurrence and value data for each shop each month. Within these two classifications, each sampling method was compared statistically with the others and the population. This was done to determine the sample size and sample method that is most efficient for identification and estimation of the variation within the population.

Data from the 12 shops, when arranged into two areas of six shops each, showed extremely high F values for variation among shops. There were lesser F values for variation between the two areas and among the seven months. "All retail sales" showed a greater amount of variation among months than did "arrangement sales."

Analysis for differences among the three sampling methods showed no significant differences.

Further analysis for frequency level confidence using 10, 20, 30, 40 and 50 frequencies replicated five times showed no sampling method differences. The "In-Shop" systematic method, therefore, was selected for individual sales analysis of each of these levels.

This analysis yielded high significance at the 40 and 50 frequency levels. Further comparison with the population values for these same frequencies, yielded significance at 40 and high significance at 50 frequencies. These frequency levels are higher than those indicated in the literature to be necessary for validation in the case of a normal frequency distribution. Skewness of distribution is the probable reason for the higher frequency level needed for significance in these data.

In order to obtain reliable information about retail flower sales, these recommendations can be made:

(a) At least 40 to 50 frequencies of occurrence need to be recorded in each category, such as the frequency of sales for birthdays for any month.

(b) About 5,000 total orders or items need to be recorded per area or unit under observation per year. This sample number will need to be increased with each segmentation if greater detail is desired.

(c) The data from flower shops being investigated should have a similar skewness of distribution of sales to use these standards.

Other intervals of sampling probably can be used, provided the above precautions are met. Raising the total number in the sample or combining some categories may be necessary in order to meet the requirements for minimum frequencies for reliability.

Percentage fluctuations from the population by the "In-Shop" systematic samples in general follow a pattern of low frequency-higher fluctuation, high frequency-lower fluctuation.

Organizations in the florist and allied industries with punched card equipment can also avail themselves of such sampling techniques provided they observe the proper pre-

cautions of minimum frequencies in each classification where information is desired.

Microfilm \$2.75; Xerox \$7.20. 152 pages.

PREDICTORS OF ORGANIZATIONAL LEADERSHIP

(Order No. Mic 61-1036)

Albert Leslie Porter, Ph.D.
Stanford University, 1961

1. Statement of the Problem: An alumni follow-back validity study. Population: 428 men receiving Master of Business Administration (MBA) degree from Stanford University Graduate School of Business before 1944 and returning usable questionnaires in School's 1958 vocational survey of alumni.

2. Methodology: Linear correlation analysis using simple Pearson product-moment coefficients. The six simple criteria of organizational leadership achievement ("success") as of 1958 are: pay (normalized for time out of school), policy authority, level in organization (adjusted for organization-size), career progress satisfaction, job interest, and being in general management. Criteria all coded from the vocational survey response. Twenty-six simple predictors were coded from: descriptive graphic rating scales completed by undergraduate professors, by Business School faculty, and by subjects on selves; undergraduate-college extracurricular achievements; Strong Vocational Interest Blank (SVIB) scores; age at MBA; financial self-help for MBA; undergraduate major (engineering vs. other); absence of mathematics-dislike; intelligence test score; and career aspirations. All predictor-information available at Stanford prior to subjects' receipt of MBA.

3. Findings: After matrix was adjusted for effects of chance variation each of the following predictors showed significant (5% level or better) correlation with one or more criteria: Business School faculty ratings, SVIB MF scale, age at MBA, undergraduate major, and financial self-help for MBA.

4. Conclusions: Socio-economic origin may have been the true underlying factor for financial self-help and age at MBA. Criterion "contamination" was probably present in varying amounts in the validity coefficients. Use of these findings as selection-aids by graduate schools of business and by industry must take into account factors such as: small criterion-variance accounted for by predictor-variance, public-policy clashes, this study's special population, and the changing nature of the business world. Further specific research is suggested. One should be wary of any person claiming, at this primitive stage of executive-selection research, to be able to identify the potential organizational leader.

Microfilm \$3.40; Xerox \$11.95. 264 pages.

**AN INQUIRY INTO THE USE OF
MATHEMATICAL MODELS TO
FACILITATE THE ANALYSIS AND
INTERPRETATION OF COST DATA**

(Order No. Mic 61-2543)

Robert Boyce Sweeney, Ph.D.
The University of Texas, 1960

Supervisor: Dr. G. H. Newlove

The need for mathematics in analyzing business problems has received an ever-increasing amount of emphasis during the past few years. While much has been written about this need, few concrete recommendations have been submitted on the specific mathematical requirements which should be included in the formal education of business administration students, particularly industrial accounting majors.

In this dissertation the need for conducting mathematical cost analyses is carefully analyzed and recommendations are presented as to the areas of mathematics in which training should be required. To illustrate specifically how the recommended mathematical background will prepare individuals for conducting mathematical cost analyses, detailed illustrations of various applications are provided.

After the factors contributing to the need for using mathematical techniques are reviewed, attention is directed to the use of models as the means for applying mathematical techniques to business problems.

A background which includes college algebra, analytic geometry, statistical mathematics and, at least, comprehension of the capabilities of differential calculus would provide the average accounting student with adequate preparation for preparing all but the more advanced types of analyses.

Research in the uses of higher mathematics should continue and accounting students excelling in mathematics should be encouraged to acquire additional mathematical training; however, the really advanced work required an accomplished mathematician and it is unreasonable to expect an individual to have extensive training in both mathematics and accounting. Instead, by obtaining a solid background in the rudiments of mathematics and knowing the capabilities of more advanced mathematical methods, the accountant can recognize problems susceptible to mathematical treatment. Where his capacities permit, he can construct models to facilitate cost analysis. Where his capacities are exceeded, he should call on a trained mathematician and then serve as a link between operating personnel and the mathematician, providing the mathematician with an understanding of the financial aspects of the problem and communicating the results of the analysis to operating personnel.

Detailed illustrations of the construction of mathematical models are provided to indicate the range of analysis available to an accountant trained in the recommended areas of mathematics. Several elementary models are constructed using simple mathematical techniques before progressing to more advanced models. The application of mathematical methods to these problems is illustrated in detail to facilitate comprehension, even by those with limited mathematical backgrounds.

Particular attention is devoted to the use of models in forecasting and financial planning, as well as the use of learning curve models. While much has been written on the use of the learning curve, no comprehensive discussion of the techniques is available. An effort is exerted to fulfill this need by presenting the various computational techniques in detail and illustrating the application to several accounting problems.

A definite need exists for conducting the types of cost analyses that are possible only through the use of mathematical models. The burden has been placed upon accountants, primarily those in the teaching profession, to acknowledge this need and prepare themselves and, important, prepare the future accountants for performing the function which is logically theirs.

Microfilm \$6.30; Xerox \$22.30. 495 pages.

ECONOMICS, FINANCE

**THE ROLE OF A CIVIC AGENCY IN
THE DECISION-MAKING PROCESS AT THE
LOCAL GOVERNMENTAL LEVEL**

(Order No. Mic 61-2635)

Herbert J. Ranschburg, Ph.D.
New York University, 1958

Adviser: Richard A. Girard

The steady growth of local government and its impact on the allocation of scarce resources raise to high importance the decision-making process by which local government seeks to attain maximum welfare for the people. The thesis of this dissertation is that this governmental growth has been paralleled by an increase in the demonstrable influence of voluntary civic organizations, and that, under democratic government, this influence is not a matter of chance but is based on factors inherent in the governmental decision-making process. As far as concerns the City of New York, this country's second largest single unit of government, this influence can be demonstrated by the twenty-five year experience of one such civic organization, the Citizens Budget Commission, Inc.

Positions taken by the Citizens Budget Commission on a number of fundamental issues in public finance and administration have been reflected, sooner or later, in one form or another, in decisions taken by the government of the City of New York. These issues encompassed, among others, expense and capital budgeting, City charter and State constitutional reform, municipal labor policy, tax and debt policies, etc. Taking as granted the existence of (politically determined) governmental ends, the function of a civic agency appears to be to suggest alternate means toward the achievement of previously set ends and/or to elucidate the total consequences of any proposed governmental course of action. Thus, opportunities for civic action arise because any given governmental end can be achieved by different means, and because the extreme complexity of both governmental ends and means makes it

difficult even for their proponents to realize all their consequences and effects. The effectiveness of a civic organization is likely to be proportional to its non-partisanship and its ability to base its proposals on facts, figures and logic. For this reason, the technical skill of its research staff plays a large part in its ultimate contribution to decision-making on the local governmental level.

The premises employed by governmental agencies are usually narrower than those employed by outside agencies such as CBC. This narrowness is explainable by their preoccupation with specific governmental activities, and outside views, based on wider premises, demonstrably provide in many instances alternate solutions which prove acceptable to governmental policy makers.

The relative indeterminacy of the governmental decision-making process, and its compulsory impact on the people within its jurisdiction, tend to justify the intervention of outside groups. In this intervention, civic groups are part of the general concern with the governmental decision-making process, providing a different mode of approach from those employed in political and pressure group types of action. Non-political organizations of a civic nature may well be the only ones who can afford to rush in where elected officials may fear to tread.

While it is usually impossible to determine effectively why a unit of government accepts the proposal of an outside agency in one case and rejects it in another, the demonstrated facts of acceptance in the instances cited in this study provide empirical evidence that the efforts made in preparing the proposal were worth while, stamping civic action as part of the democratic process of self-government. Microfilm \$2.75; Xerox \$8.40. 183 pages.

**FINANCING LOCAL GOVERNMENT IN
METROPOLITAN AREAS: A CASE STUDY
OF MADISON, WISCONSIN.**

(Order No. 61-2982)

Harvey Shapiro, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Harold M. Groves

The mayor of Madison, Wisconsin appointed a study group to consider the financial problems facing local governments in the "Greater Madison Area" during 1956. This area was defined as a nine township square with Madison as its focal point. Greater Madison, apart from the central city and its suburban villages, is entirely rural (Census definition). As the problems confronting an urban government differ in many respects from those facing its rural counterpart, it was decided to limit this thesis (which is an extension of the author's earlier work on this subject) to a study of Madison and its four suburban villages. This area was called Metropolitan Madison. The inquiry focused particularly on alternative approaches to more equitable metropolitan financing in the Madison area.

The first two chapters provide general background material, discussing the economic and political problems confronting metropolitan local government. Chapter 3 defines the geographic boundaries of Metropolitan Madison and describes the historical development of each of the

local units including a description of each local economy and its government. Chapter 4 confines itself to a general description of local finance to provide a background for Chapter 5 which contains a detailed discussion of local government finance in Metropolitan Madison. Chapter 6 summarizes the material presented in Chapters 1 through 5, explores certain welfare concepts and then applies them to the possible political-economic alternatives that were described in Chapter 2.

The existing situation causes inequitable treatment of individuals based upon their place of residence within Metropolitan Madison. Political division of the area into many units of local government results in an unequal distribution of resources and demands placed upon them. Multiple assessing jurisdictions results in inequitable treatment between different categories of property within each unit as well as among similar properties in the different governmental units. An identical situation arises when property taxes for schools are studied.

The result of this situation is that the residents of the wealthiest governments "enjoy" the lowest tax rates.

Distribution of the state shared income tax to the residence of the taxpayer also tends to favor the wealthier governments and further lowers property tax rates in these more fortunate areas.

The citizens of Madison are subsidizing all the village residents. The latter utilizes the facilities of the city while working, shopping, etc., yet contribute nothing toward the costs of maintaining these facilities. In addition, the mere existence of the city enables the villages to "get by" with a smaller municipal effort. Thus, tax revenues can be concentrated behind a few services resulting in high per-capita expenditures. This is one method — though open to criticism — of measuring service levels. However, the village with the highest property tax rates has lower per-capita expenditures for the functions studied than does its neighbors.

Finally, the city-county financial relationship was briefly analyzed. Madison contributes 62 percent of Dane County's tax receipts, yet receives few benefits from the services provided by the county. Madison does not have proportionate representation on the County Board.

The application of welfare concepts was most fruitful in describing benefits that would accrue to all parties (assuming certain specific conditions) through an inter-governmental bargain. Madison would administer the educational system for the area and in return would levy on property in all units for the support of this service.

The author's conclusion is that there is little prospect for any change in the immediate future. Vested interests in the status quo combined with a fear of what the changes might bring will tend to prevent any reorganization. Only a severe worsening of existing conditions could force this issue. Microfilm \$3.80; Xerox \$13.50. 296 pages.

**AN ANALYSIS AND APPRAISAL OF
RIGHTS OFFERINGS AS A METHOD OF
RAISING EQUITY CAPITAL**

(Order No. Mic 61-2804)

Kenneth Jay Weller, Ph.D.
University of Michigan, 1961

The rights offering is a method of raising equity capital. It involves the offering of new shares of common stock to the present owners at a price below the current market price. The new shares are offered on a pro-rata basis through rights which can be utilized or sold by the recipient shareholders. Funds, therefore, are supplied by the original owners and by the purchasers of rights.

The purpose of this study is to provide a clearer understanding of what happens in a rights offering and to suggest methods of reducing its cost and improving its effectiveness.

In the pursuit of this objective, different research methods are used. Interviews and conferences with financial officers of corporations, investment bankers, and officials of the Securities and Exchange Commission are used to obtain information on the attitudes and perspectives of various parties. Data on the response of shareholders to rights issues are developed through a mail survey. A statistical study is made of the changes in the market price of shares during a rights issue. Whenever data are assembled for specific rights issues, the issues included are all those of United States corporations which exceeded \$5,000,000 during the years 1956 and 1957.

The early portion of the study is devoted to a discussion of the historical development of the rights method and a description of its operation. The decision-making process for establishing the terms of the offering is analyzed as it affects the complementary relationship of the rights offering with other financial policies.

Subsequent sections of the thesis deal with the tendency of the market for shares to decline as a result of the large increase in the supply of the stock during a rights issue. This price decline can be measured by determining the amount of the price decline and adjusting for changes in the general market. A statistical analysis of the issues in this study indicates that the average decline in price is 5.97 percent. The measure varies from 4.07 percent for utilities to 8.04 percent for industrials.

The causes of this price decline are considered in terms of the demand for the new shares by the original holders of the stock and by nonholders who seek to purchase the rights. The demand by holders as evidenced in subscriptions is not a published fact for most issues. A mail survey reveals that a number of firms have this type of information but that it is very difficult to draw any conclusions from the reported data. The wide variation in the methods of collecting and reporting makes comparison and consolidation difficult. There is sufficient information to suggest a method of procedure for additional research and the hypothesis that a large portion of the funds in a rights offering come from outside the ranks of the shareholders. The factors that underlie the demand by holders are discussed.

In the investigation of the demand for shares by non-holders the lay-off procedure is emphasized. The lay-off is a financial operation in which investment bankers purchase rights on the market and concurrently sell the

corresponding shares through their selling organizations. The development of this technique, its regulation by the Securities and Exchange Commission, its possibilities, and its limitations are considered at length. It appears that it can be an effective force in the prevention of price declines during the issue.

The concluding portion of the thesis examines the various aspects of the costs of a rights issue and the possibilities of the substitution or elimination of costs in maximizing its effectiveness.

Microfilm \$3.00; Xerox \$10.60. 232 pages.

ECONOMICS, HISTORY

**ENTREPRENEURSHIP, TECHNOLOGICAL
INNOVATION, AND ECONOMIC CHANGE IN THE
IRON INDUSTRY: A CASE STUDY.**

(Order No. Mic 61-2583)

Robert Alden Battis, Ph.D.
New York University, 1958

Adviser: Ralph W. Hidy

This study is concerned with the problems of business adjustment during an extended period of technological and economic change in the iron industry of the United States.

Quite often business historians tend to overemphasize the importance of survival of the business firm and consequently lose sight of the fact that firms are primarily organized for the purpose of securing economic profit. Similarly, businessmen feel the only way to insure the success of their firm is to keep it growing; simply maximizing profits is not enough. Meanwhile, the economist, in his theory of the firm, says very little about the failure of business firms, either in the economic or legal sense. Seldom does the theorist provide an analysis of the problems involved in the withdrawal of production, nor does he define or generally employ the word "failure." In the real world, however, changes in the economic data are many and frequent, and while some few firms survive by successfully adapting to the changes, many fail. But the problems of the firms that do not make the adjustments are seldom studied. Because of this orientation in both economics and business history, the oft repeated cycle of initiation, growth, and decline of business firms is given little recognition, though such studies would be more representative of business generally.

This case history of The Thomas Iron Company, a once important merchant pig iron producer, is an attempt to investigate the causes and process of business withdrawal. Attention is directed to the reasons for the frequency of business failure and to an analysis of the numerous factors that determine the failure of some firms and the survival of others. Special interest is given to the destructive nature of technological innovations.

The data used in constructing the essential framework for the understanding of the management's decision to withdraw the firm's furnace facilities from further production have been obtained from various journals,

periodicals, and statistical reports. Also, reference has been made to numerous secondary sources in order to find other independent opinions on the important forces of change at work that eventually brought about the reorganization of the iron industry. The basic data used, however, consists of the surviving records of The Thomas Iron Company covering sixty-six years (1855-1921) of business activity. Though these records are somewhat limited by the nature of the accounting techniques employed, they do provide enough information to permit both statistical analysis of production and costs and some marginal analysis, both of which have been used to arrive at a meaningful explanation of the withdrawal of the firm.

While the rise and fall of this firm is nothing exceptional, the findings of the study provide an excellent example of the destructive nature of innovations in the capitalistic economic system. In this case, the technical and organizational developments achieved by the rising steel industry not only destroyed the value of the real capital of the firm, but also precluded the firm's extension of its production. Eventually the iron company's economic freedom was sufficiently restricted by the actions of the larger steel combinations so that its management was left with only one choice - withdrawal. This history also presents ample evidence to support the thesis that many times in the business world, once the original opportunity to be exploited by a firm disappears, it is not essential that the firm survive. Survival is not necessarily the most important objective of business activity. However, if the firm's survival becomes the important objective, the management's personal characteristics and motivations become most important variables.

Microfilm \$5.90; Xerox \$20.95. 461 pages.

**ECONOMIC REGIONALISM IN THE
MIDDLE EAST DURING WORLD WAR II
(THE MIDDLE EAST SUPPLY CENTER).
(PARTS I-V).**

(Order No. Mic 60-2309)

Martin Wiznitzer Wilmington, Ph.D.
New York University, 1960

Adviser: Professor Thomas Hovet

Economic regionalism is defined as "the incipient, unfolding or accomplished creation of supra-national, decision-making agencies which carry forward a program of integration of national economies and are both emanations and tools of plans or drives for a gradual political fusion of all or most constituent territories of a political region--a region so identified either because of distinctive political relationships among its political units or because of a distinctive political role in world affairs."

Economic regionalism has found growing acceptance in recent years as a formula of international cooperation, particularly within the precincts of the United Nations. To a considerable extent this trend is held to have its roots in the genesis and success of military and civilian agencies established during the war to mobilize national economies on a regional scale in many parts of the world both for the pursuit of military objectives and the protec-

tion of civilian populations against undue hardships. Among these agencies was the Middle East Supply Center (1941-1945) set up in Cairo by the British government and later co-sponsored by the United States.

The advice and recommendations of the Center became the prime reference guiding Anglo-American allocations of shipping space and supplies for the civilian populations of the Middle East at a time when the latter were cut off from many other traditional sources of essential goods, yet had to share their resources with Allied armies quartered in their midst. The foremost objective of MESC was to reduce these allocations to a point of minimum interference with the assignment of supplies and shipping to military operations but without causing politically dangerous civilian hardships and economic dislocations in its ward area.

Nearly 30 countries in the Middle East, including Cyprus, Malta, Ethiopia and occupied Italian dependencies in East and North Africa, had to clear most of their civilian imports from Anglo-American overseas sources through the Middle East Supply Center. Imports deemed non-essential or for which substitutes could be found or produced within the Middle East and in India were disallowed. Other imports were approved only if the recipient countries agreed to MESC demands for more efficient controls of production and consumption, anti-inflation measures, more intensive trade with neighboring countries, and appropriate fiscal policies.

The result was a widely ramified system of regional self-sufficiency characterized by an expansion of local production and increased trade and economic cooperation among the countries and territories of the area. A noteworthy feature was the attempt of the Center to use the leverage of wartime pressure for the initiation of a regionally orientated and managed program of postwar economic development. A lasting legacy are many valuable studies on economic, technical and social problems which for centuries have obstructed economic progress in the Middle East. Beyond that the Center is credited with having indirectly contributed to the advancement of Arab unity and having inspired similar regional experiments in other parts of the world.

Microfilm \$5.70. Xeros 20.30. 446 pages.

ECONOMICS, THEORY

**AN INTERNATIONAL COMPARISON OF
FACTOR COSTS AND FACTOR USE**

(Order No. Mic 61-1031)

Bagicha Singh Minhas, Ph.D.
Stanford University, 1961

In economic development literature the possibilities and limits of substitution between labor and capital in different lines of industry are a popular subject for theoretical discussion. For lack of systematic information on this phenomenon, however, analyses are generally based on simple assumptions which often lead to erroneous conclusions.

The aim of this study is (1) to accumulate data on the cost of labor and capital in a large number of industries of different countries; (2) to suggest empirically usable relations for the analysis of substitution between capital and labor and to obtain statistical estimates of the elasticity of substitution between the two inputs; and (3) to derive implication from these empirical findings for some aspects of the theory of international trade and economic development.

It is argued that international cross-section data on individual industries, which form the basis of this study, are probably the best available source of information for fitting production relations. The results of log-linear regressions of labor inputs per unit of value added on wage rates in 24 three-digit industries are presented. A proof of the equivalence, under constant returns to scale, between the logarithmic derivative of value added per unit of labor with respect to wage rate and the elasticity of substitution between capital and labor is given. The typical values of this elasticity are below unity but significantly different from both unity and zero, which are the values of this parameter implied by the Cobb-Douglas and fixed coefficients production functions respectively. It is indicated that the estimates of the elasticity of substitution obtained in this study are consistent with a new production function derived primarily by Professor Arrow, which includes the fixed coefficients and the Cobb-Douglas function as its limits.

It is shown that the variability of the elasticity of substitution between capital and labor among industries leads to reversals in relative factor-intensity. It is demonstrated that these reversals often take place in the empirically relevant range of factor prices, thus spoiling the predictive significance of the Heckscher-Ohlin theory of comparative advantage and also seriously weakening the related theorem that free trade in commodities can bring about equalization of factor prices. However, an alternative interpretation of the connection between factor endowments and comparative advantage which seems to preserve some of the intuitive appeal of the factor proportions theory is suggested.

Because of the paucity of basic data, the estimates of the rate of return on industrial capital of only five countries, viz., India, Japan, the United Kingdom, Canada and the United States were made and are presented in the study. Within each of these countries, there are patterns of inter-industry differentials in average rates of return on capital which seem to persist over time. A tentative explanation of the persistence of these differentials is given. Furthermore, the finding that there are no significant differences in the over-all rate of return on industrial capital in countries of widely varying relative factor endowments is quite surprising. There are, however, marked differences in the relative profitability of particular industries among different countries, which appear to be related to comparative advantage in trade.

The study is concluded with some observations concerning the trends in sectoral utilization of capital and labor in a process of economic growth and the movements in functional shares of these factors. Some suggestions for further research are also made.

Microfilm \$2.75; Xerox \$8.20. 180 pages.

USING TECHNICAL AND SOCIAL KNOWLEDGE IN ECONOMIC DEVELOPMENT

(Order No. Mic 61-2783)

Hollis William Peter, Ph.D.
University of Michigan, 1961

The purpose of this study is to show how the creation and use of technical and social knowledge contributes in a major way to increasing productivity and to economic development. The importance of relatively intangible factors, embodying technology and social knowledge, in the social production function is shown by the fact that approximately 90 percent of the increase in per capita output in the United States over the past half century has come from intangible factors contributing to increasing productivity, while only about 10 percent has come from increased inputs of tangible physical capital.

The study examines a number of these intangible factors--basic research and development, education, and organization--which either create new knowledge or help to convert it into improved technology or higher quality producers (human capital), and explains how investments in these factors, as well as in physical capital, contribute to productivity increases. National expenditures for research and development in the United States rose from 0.3 percent to 2.5 percent of gross national product during the last twenty years; national investment in education rose at a rate four and one-half times as large as that of gross national product during the last fifty years. These findings suggest that increasing investment expenditures for these types of activities which represent greater use of technical and social knowledge, help explain productivity increases amounting to 1.7 percent annually for over fifty years after investments providing for growth of inputs of tangible physical capital have been taken into account.

One chapter of the study deals with criteria for investment in developing countries, with suggestions as to how criteria can be used for investments in research, education, health programs and other social overhead activities, as well as for the allocation of resources to physical capital development. In another chapter, knowledge is treated as an economic resource, and its special characteristics are described. A chapter on research and development is followed by one on human capital which shows how this economic stock can be enlarged, and the costs of equipping people to perform more productive activities. A chapter on business organizations deals with the ways in which improved social knowledge coming from research exerts a positive effect on productivity in these man-made social systems. A chapter on the diffusion of knowledge describes how new ideas and products spread, what groups use them first, and what kinds of information are relied on during the several stages of the adoption process. Finally, a field study is reported, describing some of the problems encountered by Filipinos attempting to use technical knowledge acquired in the United States, in their own country's development program.

Several general conclusions can be drawn from this study. One is that technical knowledge as technology built into physical capital, and both technical and social

knowledge embodied in skilled people and efficient organizations, are among the major dynamic elements making possible increasing productivity and economic development. Another conclusion is that an increased flow of technical and social knowledge precedes economic development, pointing the way to new possibilities and more effective use of the traditional factors of production. A third conclusion is that the availability of technical and social knowledge, like the availability of physical capital, is a necessary but not sufficient cause of development; a balance among these and other contributing factors seems essential. Microfilm \$7.70; Xerox \$27.45. 608 pages.

**THE ECONOMIC FUNCTIONS OF
GOVERNMENT IN EARLY ENGLISH
CLASSICAL ECONOMIC THOUGHT**

(Order No. Mic 61-2591)

Harry George Shaffer, Ph.D.
New York University, 1958

Adviser: Professor Arthur Z. Arnold

Early English classical economic thought advanced the idea that the wealth of the nation and the greatest happiness of the greatest number of its inhabitants could best be promoted if each individual were permitted the greatest possible freedom in the pursuit of his own economic interests. But "the greatest possible freedom" did not mean completely unrestrained liberty, for the early English classical economists were not anarchists. There were certain economic functions which they thought should, in the interest of society, be performed by the State. The purpose of this study is a detailed investigation of the extent, the scope, the areas of economic endeavors which early English classical economic thought reserved for the government.

Six economists have been chosen for this investigation, i.e., Adam Smith, Jeremy Bentham, Thomas Robert Malthus, David Ricardo, James Mill, and John Stuart Mill, and their writings have been carefully searched for any "exceptions" to their general rule of laissez-faire.

After an introduction describing the purpose, scope, coverage, and treatment of the subject matter under investigation, and after a background chapter on pre-

classical, Mercantilist philosophy, the views of the six economists (referred to above) on the economic functions of government in general are analyzed. Starting with Chapter III, the subject matter is treated on a topical basis. Major areas of economic activities are taken up in each chapter, subdivided into their proper components. The extent to which early English classical economic thought regarded it advisable for the government to interfere with these economic activities is investigated. The major areas covered encompass private property (including the protection, bequest, and use of private property), production and trade (including domestic, non-monopolistic industry and trade, money and banking, monopolies, government ownership and/or operation of certain industrial and mercantile projects, and foreign trade), distribution (including wages, rent, interest, profits, assistance to the needy, and the possibility of a more equal distribution of wealth and/or income), taxation and the public debt, national emergencies (including the economic aspects of war and defense, and of depressions), and other economic and semi-economic functions of government (including the economic aspects of education, of the enforcement of contractual obligations, of the preservation of the nation's health, and of the administration of justice).

The study shows that early English classical economic thought did not interpret laissez-faire as a dogma with but few exceptions. There were wide areas of economic activities which Smith, Bentham, Malthus, Ricardo, and the two Mills believed to be proper functions of the state. Utility was the test, the greatest happiness of the greatest number the guiding rod, though the burden of proof was always upon the one who wanted to exclude a certain economic activity from the general rule of laissez-faire. Thus, early English classical economic thought was not opposed to all governmental interference with laissez-faire. It was opposed, rather, to those economic activities of the state, which it considered harmful to society.

The study shows, furthermore, that, on the question of governmental intervention, these early English classical economists agreed in some cases with each other, disagreed in others. There was, for instance, quite general agreement that taxation of luxuries was preferable to taxation of necessities, or that coinage was properly an economic prerogative of the State. But on such issues as government control of the rate of interest, restrictions on the importation of corn, public employment and maintenance of the poor, and many others, diversity of opinion prevailed. Microfilm \$5.25; Xerox \$18.70. 412 pages.

EDUCATION

EDUCATION, GENERAL

AN EVALUATION OF HEALTH SERVICES IN ELEMENTARY SCHOOLS

(Order No. Mic 61-2878)

Fred Oliver Bryant, Ed.D.
Arizona State University, 1959

Abstract not available.

Microfilm \$2.75; Xerox \$8.40. 183 pages.

EFFECTS OF JUNIOR COLLEGE FINANCE PLANS IN THE UNITED STATES ON POTENTIAL JUNIOR COLLEGE DISTRICTS IN ARIZONA

(Order No. Mic 61-2879)

Dell Chamberlain, Ed.D.
Arizona State University, 1959

Abstract not available.

Microfilm \$2.75; Xerox \$6.80. 144 pages.

ANTICIPATED ENROLLMENT AND CAPITAL OUTLAY NEEDS OF ARIZONA PUBLIC SCHOOLS

(Order No. Mic 61-2880)

John Kusma Crnkovic, Ed.D.
Arizona State University, 1955

Abstract not available.

Microfilm \$2.75; Xerox \$9.45. 209 pages.

A HANDBOOK FOR STUDENT TEACHERS IN SECONDARY SCHOOL MUSIC

(Order No. Mic 61-2881)

Richard Ecker, Ed.D.
Arizona State University, 1956

Abstract not available.

Microfilm \$3.05; Xerox \$10.80. 236 pages.

AN ANALYSIS OF THE ACTIVITIES OF PARENT-TEACHER ASSOCIATIONS IN THE STATE OF ARIZONA

(Order No. Mic 61-2882)

Melvin C. Erickson, Ed.D.
Arizona State University, 1958

Abstract not available.

Microfilm \$3.90; Xerox \$13.75. 304 pages.

SELECTED RESOURCE UNITS FOR THE HOLY DAYS AND FESTIVALS OF JUDAISM IN SEVENTH, EIGHTH, AND NINTH GRADES IN AMERICAN REFORM JEWISH RELIGIOUS SCHOOLS.

(Order No. Mic 61-2883)

Morton C. Fierman, Ed.D.
Arizona State University, 1960

Abstract not available.

Microfilm \$3.00; Xerox \$10.60. 231 pages.

ANTECEDENTS OF THE ST. JOHN'S COLLEGE GREAT BOOKS CURRICULUM FOUND IN RENAISSANCE ENGLAND: A SURVEY IN THE HISTORY OF IDEAS.

(Order No. Mic 61-2884)

William A. Haarstad, Ed.D.
Arizona State University, 1959

Abstract not available.

Microfilm \$2.75; Xerox \$9.00. 197 pages.

A STUDY TO DETERMINE THE PROCEDURES USED IN PREPARING BUDGETS IN SELECTED LARGE HIGH SCHOOLS IN SOUTHWESTERN UNITED STATES

(Order No. Mic 61-2885)

Clifton L. Harkins, Ed.D.
Arizona State University, 1960

Abstract not available.

Microfilm \$2.75; Xerox \$6.40. 134 pages.

**A LANGUAGE ARTS COURSE OF STUDY FOR
A SOUTHWESTERN HIGH SCHOOL**

(Order No. Mic 61-2886)

Harriet Elizabeth Herlihy, Ed.D.
Arizona State University, 1959

Abstract not available.

Microfilm \$7.20; Xerox \$25.45. 565 pages.

**NUMBER CONCORD IN
ENGLISH AND HILIGAYNON**

(Order No. Mic 61-2761)

Loreto Grajo Juntado, Ph.D.
University of Michigan, 1961

This study is a descriptive-comparative work predicting interference for Hiligaynon speakers in learning number concord in English. It aims to test the hypotheses that (1) through a systematic comparison of the native language of the student and the foreign language to be learned, it is possible to predict the learning problems and the amount of facilitation and interference encountered in the learning process, (2) the amount of facilitation and interference encountered is a function of the degree of similarity and difference in the structure of the two language systems, and (3) if points of facilitation and interference in learning can be predicted, then it is also possible to verify these predictions by testing.

Underlying the research are the assumptions that (1) individuals tend to transfer the forms and meanings and the distribution of forms and meanings of their native language to the foreign language both productively when attempting to speak the language, and receptively when attempting to grasp and understand the language as practiced by natives, (2) in the transfer phenomenon there is an influence of previous linguistic habits upon second-language learning, (3) when the structures of the native and the foreign language do not differ fundamentally, the student will have very minor learning problems, and (4) when the native language differs fundamentally in structure from the foreign language, major learning problems will occur.

Structural descriptions of the two languages were first presented. Then a pattern-to-pattern comparison was made on the basis of the factors of form (F), meaning (M), and distribution (D). Form refers to the shape of the individual linguistic elements, i.e., the sounds and their arrangement and the units which they constitute. By meaning is meant the grammatical meaning of singularity and plurality; and by distribution, the permitted environments or situations in which each form with its corresponding meaning occurs.

The structural comparisons first dealt with the patterns of number in each concord element. These patterns were classified into four levels of difficulty depending on the number of similar and different factors. The patterns of number concord were, likewise, classified into four levels of difficulty on the basis of the total number of different factors presented by both concord elements. In both cases, the four levels of difficulty were arranged in an ascending order from A to D.

Predictions of learning problems which were revealed through the systematic comparison were then made. Since the process of recognition proceeds in a different manner from that of production, there were separate pattern-to-pattern comparisons and descriptions of learning problems for each. To verify these predictions, tests were constructed and administered to 396 Hiligaynon students. In the interpretation of test results, statistical procedures were used to test the significance of the differences in the proportion of wrong responses between the predicted group levels.

Within the limitations of the linguistic analysis and comparison of the structures involved in the two given languages and the testing instrument used, the results of the study proved the assumptions underlying the research and validated the hypotheses set forth. The test results verified the predictions made. The proportion of wrong responses increased from one level of difficulty to the next. Moreover, the differences in the proportion of wrong responses between the predicted group levels were statistically significant.

The study, therefore, has shown and validated a technique of procedure that can be used in any linguistic comparative work that goes into the prediction and quantifying of learning interference and facilitation. Applied to a particular aspect of the English language, the principles underlying the procedure used here can be adapted to other aspects of the language and to other specific local conditions. In the Philippines, for instance, there is a vital need for carrying over this kind of study to other Philippine languages and to other aspects of the language as tense and case.

Since the study has demonstrated a procedure by which problems in the learning of a foreign language can be fairly well predicted, it has considerable importance for foreign language teachers. It is valuable specifically for those who teach English as a foreign language in the Philippines, but it has general implications for the preparation of teaching and testing materials as well as for classroom procedure in the teaching and learning of any language. Microfilm \$2.90; Xerox \$10.15. 224 pages.

**THE RELATIONSHIP OF PARENTAL
IDENTIFICATION TO THE QUALITY OF
INTERPERSONAL RELATIONS IN THE CLASSROOM**

(Order No. Mic 61-2887)

Stephen John Kimler, Ed.D.
Arizona State University, 1958

Abstract not available.

Microfilm \$3.00; Xerox \$10.35. 230 pages.

**A LANGUAGE ARTS COURSE OF STUDY FOR
A SOUTHWESTERN HIGH SCHOOL**

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Underlying the research are the assumptions that (1) individuals tend to transfer the forms and meanings and the distribution of forms and meanings of their native language to the foreign language both productively when attempting to speak the language, and receptively when attempting to grasp and understand the language as practiced by natives, (2) in the transfer phenomenon there is an influence of previous linguistic habits upon second-language learning, (3) when the structures of the native and the foreign language do not differ fundamentally, the student will have very minor learning problems, and (4) when the native language differs fundamentally in structure from the foreign language, major learning problems will occur.

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**THE RELATIONSHIP OF PARENTAL
IDENTIFICATION TO THE QUALITY OF
INTERPERSONAL RELATIONS IN THE CLASSROOM**

(Order No. Mic 61-2887)

Stephen John Kimler, Ed.D.
Arizona State University, 1958

Abstract not available.

Microfilm \$3.00; Xerox \$10.35. 230 pages.

RECOMMENDED TECHNIQUES FOR IN-SERVICE EDUCATION OF TEACHERS OF MENTALLY RETARDED CHILDREN IN STATE INSTITUTIONS

(Order No. Mic 61-2888)

Joseph S. Lerner, Ed.D.
Arizona State University, 1957

Abstract not available.

Microfilm \$2.75; Xerox \$8.40. 181 pages.

AN EVALUATIVE STUDY OF GUIDANCE COUNSELOR CERTIFICATION IN THE UNITED STATES

(Order No. Mic 61-2889)

David O. Lloyd, Ed.D.
Arizona State University, 1960

Abstract not available.

Microfilm \$2.85; Xerox \$9.90. 218 pages.

AN EXPERIMENTAL AND THEORETICAL STUDY OF THE POSSIBLE RELATION BETWEEN SUBJECTIVE TIME AND BEHAVIOR

(Order No. Mic 61-2890)

Dallas Crutcher Long, Ed.D.
Arizona State University, 1957

Abstract not available.

Microfilm \$2.75; Xerox \$4.20. 78 pages.

EQUALIZATION LEGISLATION FOR ARIZONA

(Order No. Mic 61-2891)

Stanley Poe, Ed.D.
Arizona State University, 1954

Abstract not available.

Microfilm \$5.40; Xerox \$19.15. 421 pages.

THE ROLE OF THE STUDENT PERSONNEL ADMINISTRATOR IN THE PUBLIC JUNIOR COLLEGE

(Order No. Mic 61-2892)

John Dell Riggs, Ed.D.
Arizona State University, 1960

Abstract not available.

Microfilm \$3.70; Xerox \$13.05. 288 pages.

AN ANALYSIS OF SELECT NAVAHO NEEDS WITH IMPLICATIONS FOR NAVAHO EDUCATION

(Order No. Mic 61-2893)

Robert A. Roessel, Jr., Ed.D.
Arizona State University, 1960

Abstract not available.

Microfilm \$3.45; Xerox \$11.95. 265 pages.

CULTURE CONTACT AS A DYNAMIC OF SOCIAL CHANGE: A STUDY OF THE TREATMENT OF THE BLIND IN INDIA.

(Order No. Mic 61-2567)

Subodh Chandra Roy, Ph.D.
New York University, 1961

The purpose of this investigation is to find out how Western culture in general, and British culture in particular, influenced the culture of India, and specifically to determine to what extent social attitudes toward, and treatment of, the Indian blind changed as a result of this influence.

The importance of this study lies in the fact that the determination of the extent of the influence of Western culture on India will lead to a greater knowledge of these two great cultural traditions and, thereby, promote the cause of peace and harmony in the world.

Another need for this research is more specific. There has been very little study in any Oriental country about blindness and the blind from the standpoint of cultural influence. This investigation, by indicating the extent of Western influence on the improvement of the conditions of the blind in India, may be a guidepost along the way to accelerate welfare work for the blind in other Oriental countries.

The method adopted in this research is historical. The period covered in this study is approximately thirty-five hundred years.

For information concerning the attitudes of the Indian people toward the blind prior to contact with Western culture, the following sources have been used:

The Vedas, the Upanishads, the Laws of Manu, and a few accredited volumes on Indian cultural history. Several books and articles by Eastern and Western authors have also been cited to examine the authenticity of interpretations of the primary sources. In order to demonstrate how the attitude toward the blind was depicted in the early Christian culture, passages from the King James version of the Bible have been cited.

These materials have been examined for evidence bearing upon attitudes toward the blind with respect to their position in society, their legal rights to inheritance and the holding of property, their right to participate in religious functions, their right to marriage, and their right to education.

The impact of Western culture on Indian thought has been tested by the criteria of temporal priority, dependence, awareness, and similarity. Some of the culture-contact agents, used in this research, in order to examine

the hypothesis that social attitudes toward the blind in India and work on their behalf have changed due to India's association with the West, are:

- A. Work of Christian missionaries, including medical missionaries;
- B. Conversion of Hindus to Christianity;
- C. Influences exerted by Indian students after their studies in England;
- D. Social legislation instituted by the British Government, and continued as well as expanded by the Government of independent India; and
- E. The secular system of education introduced by the British Government and continued by the present Government of India.

It has been shown that the texts of the early Vedic literature, albeit extremely meager, expressed a good deal of concern for the well-being of sightless and otherwise physically disabled persons. The religious philosophy of India soon became predominantly transcendental and otherworldly. This change was reflected in the ethical conduct of the Hindus and their attitude toward persons with physical disabilities. This state of affairs continued until India's serious confrontation with Western culture toward the end of the eighteenth century. Due to the culture-contact agents, previously enumerated, the Indian people experienced significant changes in their social and humanistic outlook. As a result, the blind and other physically handicapped persons are receiving much greater help and attention in the process of their becoming rehabilitated as happy and contributing members of society.

Microfilm \$4.45; Xerox \$15.55. 345 pages.

OFFICE SERVICE EMPLOYMENT FOR WOMEN COLLEGE GRADUATES IN METROPOLITAN OKLAHOMA CITY

(Order No. Mic 61-2723)

Lois Adele Thompson, Ed.D.
The University of Oklahoma, 1961

Chairman: Professor G. A. Porter

This study consisted of an investigation of the circumstances surrounding the employment of 121 women college graduates in office service positions, their opportunities for advancement, and the nature of their educational backgrounds. In addition, it involved an analysis of the statements made by personnel managers and women employees relative to specific employment practices and procedures utilized in various offices.

The author interviewed 50 personnel managers and 121 women college graduates employed in office service occupations. Other data were obtained from office manuals and published materials distributed by the personnel managers.

The conclusions reached in this study are:

1. Utilization of available womanpower in the form of women college graduates is not currently being accomplished to the extent possible. This is true largely be-

cause of lack of uniformity in the use of this labor resource and because positions requiring the services of college women have not been standardized. Women college graduates are employed in office service occupations largely by chance when they seek positions without knowing whether those positions will demand their capacities, and in turn, the employers hire graduates without giving much thought to whether challenge for the employees exists in the jobs.

2. Excellent opportunities exist for women college graduates in employment in certain office service occupations and there is a trend toward more effective use of women in this regard. This is true because some personnel managers are becoming increasingly aware of the promotional possibilities for college women. Women can readily begin careers in business in clerical or stenographic positions and with experience move into supervisory or administrative positions.

3. Beginning positions in business organizations available to women college graduates are at the lower levels. College preparation must be combined with work experience before opportunities for decision making, exercising of judgment, and other challenging elements become available through promotions to higher level jobs.

4. The preparation of women college graduates for office service employment should include more individual counseling along with an increased amount of practical experience. Only when this is done will women graduates be appropriately oriented regarding business occupations and their opportunities in them.

5. The preparation of women for office service employment should include provision for more opportunities for women to gain better backgrounds in English usage. Communication skills are vitally important and essential in office service occupations and women college graduates are expected to be able to communicate effectively. Unless more opportunities are provided in college for women to improve their handling of the tools of communication, women will continue to be unaware of the significance of such tools until the need for them actually arises in their jobs.

6. Institutions of higher learning should provide basic business courses for women pursuing degrees in various fields other than business. Women college graduates are frequently employed in business occupations regardless of their degrees or the fields of study they pursue, and women with degrees in fields other than business are usually not informed regarding fundamental business processes and procedures.

Microfilm \$2.75; Xerox \$8.40. 181 pages.

A SURVEY OF THE YOUTH-SERVING AGENCIES OF THE PHOENIX METROPOLITAN AREA

(Order No. Mic 61-2894)

Elbert Clyde Thoroman, Ed.D.
Arizona State University, 1956

Abstract not available.

Microfilm \$2.75; Xerox \$9.70. 211 pages.

**AN APPRAISAL BY PARENTS OF SUPERIOR
ABILITY YOUTH REGARDING
COLLEGE ATTENDANCE**
(Order No. Mic 61-2895)

Ray N. Waggoner, Ed.D.
Arizona State University, 1959

Abstract not available.

Microfilm \$3.70; Xerox \$13.05. 288 pages.

**THE VALUE OF SELECTED PUBLIC RELATIONS
PRACTICES IN BUILDING GOODWILL
BETWEEN SCHOOL AND COMMUNITY**

(Order No. Mic 61-2896)

Morrison F. Warren, Ed.D.
Arizona State University, 1959

Abstract not available.

Microfilm \$2.75; Xerox \$6.60. 140 pages.

**A STUDY OF WORKMEN'S COMPENSATION
REHABILITANTS RECEIVING LUMP-SUM
AWARDS FOR SELF-EMPLOYMENT:
A COMPARATIVE ANALYSIS OF THE
SOCIOLOGICAL, EDUCATIONAL, ECONOMIC,
PHYSICAL AND FOLLOW-UP SUCCESS
OR FAILURE CHARACTERISTICS OF EACH
INDIVIDUAL IN SELF-EMPLOYMENT.**

(Order No. Mic 61-2579)

Marvin R. Wayne, Ed.D.
New York University, 1961

The purpose of this investigation was to make a study of all workmen's compensation cases which received compensation funds to enter self-employment, and to determine whether or not there were any significant characteristics among those deemed successful and those deemed unsuccessful in self-employment. The findings, if significant, could possibly be used for prognostication in similar situations in a vocational rehabilitation program.

The cases for follow-up and analysis were taken from the closed files of the New York City office of the Division of Vocational Rehabilitation for the fiscal year 1954-1955. The fifty-five male cases that resulted were workmen's compensation cases involving a lump-sum award for purposes of entering self-employment.

The study was conducted by an investigator who, at the time the study was instigated, was a vocational rehabilitation counselor assigned to the workmen's compensation unit.

Written permission was obtained to use the closed files and the data from the records were placed on worksheets.

A letter explaining the study and containing an appointment form and a stamped self-addressed envelope was sent to all rehabilitants asking them for a personal interview.

Within two weeks, a letter setting up an interview was sent to those responding affirmatively. At the same time, a second letter was sent to those who did not respond to the first letter.

A follow-up letter was sent to those rehabilitants who responded negatively for further clarification of the study's aims and goals. Those continuing to respond in the negative or who did not respond at all were eliminated for purposes of this study.

A personal interview was conducted with the fifty-five rehabilitants who responded affirmatively at their places of business, homes, or the Division of Vocational Rehabilitation. The data were added to the worksheets and processed for statistical interpretation.

The final tabulation showed that of the fifty-five cases used, twenty-one, or 38.2 per cent of the sample, were still self-employed in the same business. These were considered successful cases. Thirty-four, or 61.8 per cent of the sample, were found to be unemployed, self-employed in different businesses, or working in regular employment. These were considered unsuccessful cases.

The characteristics considered for evaluation included age, education, marital and veteran status, number of dependents, previous vocational training, former employment, income, sources of support, self-employment experience, disability, time in rehabilitation, services received from the Division of Vocational Rehabilitation, costs to the Division of Vocational Rehabilitation, amount of lump-sum award and part of lump-sum award used in self-employment, effect on physical condition, severity of disability, attitudes toward the Division of Vocational Rehabilitation's services, and reasons for discontinuance of business.

The data indicated that in only four of the above characteristics were there any statistical significance at the .01 or .05 level. These included (1) previous experience in self-employment, (2) the sources of support maintaining the client from onset of disability until rehabilitation takes place, (3) the proportion of the lump-sum award used in self-employment, and (4) the effect of self-employment on the client's physical condition.

The results appear to indicate that it would not be feasible to use these few significant characteristics to prognosticate success or failure in placing similar workmen's compensation clients in self-employment. Additional research seems to be indicated. It would also appear that further evaluation by the Division of Vocational Rehabilitation in regard to their existing program for rehabilitating workmen's compensation clients is needed. Additional rehabilitation services might have been beneficial to many of the clients who were not aware of the services available to them. A closer working relationship between the compensation, rehabilitation, and welfare authorities would be beneficial to all concerned.

Microfilm \$2.75; Xerox \$5.80. 118 pages.

PRIMARY AIMS AND APPROPRIATE ACTIVITIES OF MICHIGAN PUBLIC SECONDARY SCHOOL STUDENT COUNCILS

(Order No. Mic 61-2803)

Donald Clifford Weaver, Ed.D.
University of Michigan, 1961

This is a study to determine the extent of agreement between Michigan public secondary school principals and selected national student council authorities regarding the primary aims of the student council and to determine the extent to which, in the opinion of a panel of national authorities, the activities sponsored by Michigan public secondary school student councils implement the primary aims of the student council.

The methodology involves a 20 percent systematic sampling of the principals of the secondary schools accredited by the University of Michigan during the 1957-58 school year and the polling of a panel of national student council authorities--one from each of forty-four different states. Data are collected by means of two mailed questionnaires to each group--principals and national authorities. Wherever appropriate, the chi-square test is applied to the data to determine the significance of relationship.

Although incidental to the collection of data pertinent to the present investigation, information is included which shows the relationship between the quality of student council activities sponsored in Michigan schools and tenure of the principal, tenure of the adviser, principal's rating of student council effectiveness, frequency of council meetings, and size of school.

Results of the study indicate:

1. Michigan principals and national authorities agree substantially regarding the primary aims of the student council. Primary aims include those objectives which involve the promoting of leadership opportunity and good citizenship, the improving of service to the school, and the promoting and regulating of the activity program. Principals and authorities reject as primary those aims directed toward the raising of funds, the disciplining of students, the implementation of previously determined administrative policy, and participation in community service projects.

2. Activities reported most frequently by Michigan student councils include those which serve the following functions: fund raising, regulating of the activity program, providing a social activity program, purchasing school equipment, and participating in student council conferences.

3. Least frequently reported activities are: assisting in school management and policy formulation, providing school services, participating in community service projects, improving citizenship and leadership opportunity, and disciplining students.

4. A statistically significant relationship is found between the quality of activities reported and the teaching area of the adviser, the size of the school, and the frequency of council meetings. No statistically significant relationship is found between the quality of activities sponsored and tenure of the principal, tenure of the adviser, and the principal's rating of council effectiveness.

Conclusions from the study are:

1. There is considerable discrepancy between the number of Michigan councils reporting an activity and the

opinion of the panel of national authorities regarding the worth of the activity in implementing the primary aims of the student council. Much of the effort among Michigan student councils is directed toward activities which, in the opinion of national authorities, do not contribute substantially toward the implementing of primary student council aims.

2. Judgments of the panel of national authorities indicate a need for more activities directed toward developing leadership, promoting student activity programs, creating a harmonious relationship between the faculty and students, encouraging high standards of scholarship, and conveying student opinion to the staff.

3. Schools in which principals serve as advisers tend to report fewer activities judged to be highly contributory to accepted student council aims than do those schools in which the guidance personnel serve as advisers.

4. Large schools sponsor significantly more highly contributory activities than do small schools.

5. Schools holding council meetings once per week or oftener report more highly contributory activities than do schools holding meetings less often than once per week.

Microfilm \$2.75; Xerox \$8.80. 193 pages.

THE EFFECTIVENESS OF A MEDICAL CONTROL, WORK TRAINING, EMPLOYMENT, AND PLACEMENT PROGRAM FOR EPILEPTIC ADULTS.

(Order No. Mic 61-2897)

Robert G. Wolfson, Ed.D.
Arizona State University, 1960

Abstract not available.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

EDUCATION, ADMINISTRATION

A STUDY OF THE ACADEMIC SUCCESS OF HENRY FORD COMMUNITY COLLEGE GRADUATES TRANSFERRING TO THE UNIVERSITY OF MICHIGAN

(Order No. Mic 61-2322)

Albert M. Ammerman, Ed.D.
Wayne State University, 1960

Adviser: W. Ray Smittle

Purpose of the Study

The purpose of this study has been an attempt to ascertain the academic success of Henry Ford Community College graduates transferring to the University of Michigan. One of the most effective evaluations of the standards of achievement for the transfer student at the community college level is in terms of his academic success in upper-division work. If the community college is to be looked to

increasingly as a means of accommodating a high proportion of freshmen and sophomore students the question of how successful the community college is in preparing students for senior institutions must be investigated. The answer to this question is highly important in determining the role and expectations of the community college in the system of American higher education. If the community college does an acceptable job in performing the transfer function, it may well be looked to increasingly to perform the lower-division phase of higher education. Only by follow-up studies can a community college learn about the performance of its graduates in senior institutions. Investigations must be conducted in individual institutions as well as in different institutions otherwise fallacious generalities from one senior college to another may be made. The design as developed in this study could well be used for continuous follow-up studies of community college transfers.

Procedure Followed in the Study

The procedure followed in this study involved a comparative study and analysis of the academic records of 154 Henry Ford Community College graduates in both institutions. Scholarship as measured by grade-point averages and persistency to graduation have been the two main criteria used for most of the important comparisons in the investigation. The basic questions under investigation have been the following: (1) How successful academically are the graduates of Henry Ford Community College after transferring to the University of Michigan? (2) To what degree do the transfer students maintain, improve upon, or fail to maintain their lower division level of scholarship? (3) In what manner do the transfer students perform in the various schools and colleges of the university? (4) What was the extent of academic disciplinary actions imposed upon the transfer students in their upper division work? (5) What was the staying power of the transfer students and their persistence to graduation?

Conclusions

1. A student graduating from Henry Ford Community College and transferring to the University of Michigan can expect to have his grade-point average drop approximately 0.5 of a grade point in his first semester after transfer.

2. The sharp decline in average grades at the end of the first semester of upper division study at the university is followed by a gradual rise in grade-point averages, but the total transfer students never quite equaled the cumulative mean grade-point average they had at the time of graduation from Henry Ford Community College.

3. By the end of the third semester after transfer, the transfer students had adjusted to the university, for the caliber of their work had improved to a point where they maintained a grade-point average which closely approached their pretransfer averages.

4. Of the 154 transfer students, 73 per cent persisted at the University of Michigan and received their baccalaureate degrees.

5. Forty-two transfer students -- 27 per cent -- withdrew from the university for either academic or nonacademic reasons. Thirteen students -- 8 per cent -- withdrew for nonacademic reasons, and twenty-nine -- 19 per cent -- were required to withdraw because of poor scholarship.

6. The transfer students entering with a 2.5 and above average made higher scholarship records, were more successful in persisting to a degree, suffered fewer probationary actions, and had fewer withdrawals because of poor academic performance than did the transfers entering with less than a 2.5 average.

7. The transfer students eligible to enter the University of Michigan as native freshmen outperformed the ineligible transfer students in matters of academic performance, persistence to a degree, and suffered fewer academic disciplinary actions.

8. The transfer students entering the College of Engineering and the School of Education appear to be receiving a sound preparation at Henry Ford Community College for their upper-division work, but better articulation is called for between the two institutions in regard to those students entering the College of Literature, Science, and the Arts and the School of Business Administration.

Microfilm \$3.90; Xerox \$13.75. 304 pages.

PROGRAM PROVISIONS IN MICHIGAN JUNIOR HIGH SCHOOLS FOR SUPERIOR STUDENTS IN MATHEMATICS

(Order No. Mic 61-2734)

Russell Ray Baker, Ed.D.
University of Michigan, 1961

The purposes of this study were to do the following:

- (a) Identify the various special mathematics programs for superior seventh and eighth grade pupils in all public junior high schools in Michigan;
- (b) Ascertain the relationships in eight selected schools accelerating eighth graders into algebra between the principals', teachers' and students' perceptions of the effectiveness of the programs;
- (c) Ascertain the relationships between the principals', teachers' and students' perceptions in three schools accelerating eighth graders into algebra for one-half year and the respective principals', teachers' and students' perceptions in five schools accelerating eighth graders into algebra for a full year; and
- (d) Ascertain the achievement level attained by students in the selected schools at the end of the eighth grade on standardized algebra achievement tests.

A questionnaire was sent to the principals of all junior high schools in Michigan to identify schools which had special mathematics programs for superior students in the seventh and/or eighth grade and to determine the types of programs in operation. There was an 82.8 per cent return of the questionnaire. The author himself designed and administered an opinionnaire to the principals, teachers and students in the selected schools to determine their perceptions of the effectiveness of the program.

These were the conclusions:

(1) There were special programs in mathematics for superior students in grades seven and/or eight in 17.6 per cent of Michigan junior high schools.

(2) Twenty-five and six-tenths per cent of the seventh grade students were in schools with programs available to them, while 30.5 per cent of the eighth graders were in schools with programs available to them.

(3) In the seventh grade, approximately one-third of the programs were programs of enrichment, one-third were programs of acceleration, and one-third were programs which combined enrichment and acceleration. In grade eight one-half involved acceleration into algebra, approximately one-fourth involved enrichment, and one-fourth were programs which combined enrichment and acceleration.

(4) Over ninety per cent of the special programs had been organized within the last four years.

(5) There was a significant difference between the perceptions of the teachers and students regarding the difficulty of the subject matter with the teachers perceiving it to be more difficult than the students did. There was no significant difference at the .05 level of significance in the perceptions of the principals, teachers and students to the special programs in the eight schools accelerating eighth graders into algebra on any other question.

(6) There was no significant difference at the .05 level of significance between the principals' perceptions in the schools accelerating students into algebra for one-half year and the principals' perceptions in the schools accelerating students into algebra for a full year. The same lack of significance was found between the teachers' perceptions for the two types of accelerated programs. There was, however, a significant difference at the .05 level of significance between the two groups of students. The perceptions of the students in programs accelerating them into algebra for a full year were more favorable regarding the general reaction at being in a special program, the special program's effect on other course work, the special program's effect on interest in mathematics, the level of competition in the special program, and the student interest in participation in other special programs.

(7) The perceptions of all groups were favorable to the programs.

(8) The percentile ranks for the mean standard scores on the achievement test in each of the three schools accelerating students for one-half year were 84, 81, and 67. The percentile ranks for the mean scaled scores in each of the five schools accelerating students for one full year were 97, 97, 93, 88, and 86.

Microfilm \$2.75; Xerox \$6.20. 126 pages.

THE HIGH SCHOOL PRINCIPALSHIP IN SOUTH CAROLINA

(Order No. Mic 61-2862)

Isaac Cornelious Bracey, Ed.D.
The University of Oklahoma, 1961

Major Professor: Claude Kelley

The purpose of this study was as follows:

1. To identify the professional characteristics of the Negro Secondary School Principal.
2. To identify their immediate and potential problems; and
3. To develop suggestions for their continued professional improvement.

The items following each abstract are: the price of a microfilm copy; the price of a copy enlarged by the Xerox process to 6 x 8½ inches; the number of pages in the manuscript. Please order copies by number.

This study was based upon information received from 80 of the 144 negro principals to whom questionnaires were sent. The first 60 questionnaires which were received were tabulated and analyzed. The next 20 were also tabulated and the results added to the first 60 making a total of 80. A Chi-square was computed to determine whether or not the addition of the 20 questionnaires significantly modified the results of the first 60. A value of 2.222 was obtained and this was not significant at the 0.01 level of significance. Even though it was seen that 60 returns were apparently a sufficiently representative sample, the 80 responses were used as a more comprehensive sample.

The data received were tabulated as to frequency of occurrence. Some portions of the data were compared with the recommendations of authorities in the field. Other portions were compared with the findings from other studies of the principalship or other facets of such studies which are found in the present study.

Summary of Findings

1. The South Carolina negro principal compares favorably with his white counterpart as found in Oregon and Kentucky.
2. In comparison with other high school principals, the South Carolina negro principal has similar, not lesser as often assumed, training, experience, professional outlook, and approach to educational problems.
3. If the qualifications of the principal are representative of the school faculty, present South Carolina negro high schools are probably now of similar quality to that of the South Carolina white schools.
4. It was found that 96 per cent of the South Carolina Principals are married males, with 87 per cent having been born in South Carolina. All but one were active members of a Protestant church.
5. On the average, the principals were 30 years of age at the time they accepted their first principalship and their present age is 44. They had twenty years of teaching experience as either a classroom teacher or as a principal.
6. The average size of the schools administered by the principals was 760 pupils with a staff of 28 teachers.
7. The principals earned a mean salary of \$4,637.15 and 70 per cent felt that their professional salary did not permit them to provide an adequate standard of living for their family.
8. Supervision and administration was the graduate major for 35 per cent of the principals and secondary education was the graduate major for 51 per cent of them.
9. By means of comparison with studies of principals in other states it was found that South Carolina principals were similar to them in their professional training and professional beliefs and practices. They agreed with other principals that they were often unable to devote as much time to the supervision of their staffs and the improvement of the curriculum because of time spent in teaching and the performance of routine office and clerical duties.

Recommendations

Based on the findings of the study of South Carolina Negro Secondary Principals, it is recommended that:

1. The necessary effort be made to secure conditions in individual schools which will enable the principal to

perform his primary responsibility, the supervision of instruction and the improvement of the curriculum.

2. Institutions of higher learning continue to adapt the recommendations from studies and programs sponsored by The Kellogg Foundation, The Southern States Cooperative Program In Educational Administration, and others concerned with the improvement of educational administrators.

3. The necessary effort be made to provide all schools with the necessary services, equipment and staff to meet the requirements for accreditation by The Southern Association of Colleges and Secondary Schools.

4. Continued efforts be made to the raising of salary standards of South Carolina Principals in the light of recommendations of The National Association of Secondary School Principals.

Microfilm \$2.75; Xerox \$5.00. 99 pages.

AN ANALYSIS OF FACTORS RELATED TO THE PROGRAMMING ROLE OF THE STATE 4-H CLUB LEADER IN SELECTED STATES

(Order No. 61-2943)

George LaRome Carter, Jr., Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Robert C. Clark

Purpose

This is one of three exploratory studies that attempt to analyze the State 4-H Club Leader's position in the Cooperative Extension Service. Other studies deal with the administrative and professional leadership roles.

The purpose of this study was to determine perceptions held regarding certain factors that may relate to the programming role of the State 4-H Club Leader. Perceptions were determined in terms of how the State 4-H Leader does and should perform his programming role.

Specific objectives were:

1. To formulate a theoretical model as a basis for studying a position in an administrative organization.
2. To analyze the extent of agreement among and between segments of selected state Extension staffs.
3. To analyze three theoretical leadership patterns in relation to the programming role.
4. To analyze four content areas in relation to the programming role.

The study was undertaken because of a concern as to where 4-H personnel should be structured in the state organization and how they might function.

Procedure

Eight states participated. They represented two types of organization that have a direct bearing on the functions of the State 4-H Leader's position. Georgia, Massachusetts, Minnesota, and Ohio were selected to represent

states where the position was considered administrative. Missouri, Tennessee, Texas, and West Virginia represented states where the position was described as specialist.

The 377 respondents included all members of the 4-H staffs, administrators, supervisors, and a specialist from each department concerned with the 4-H program.

The study design was based on the theory that administration is a social process. The data-collecting instrument was developed from a balanced block design representing two levels--theoretical leadership patterns and content areas. The design and methodology was patterned from an adaptation of Stephenson's Q-technique and methodology, developed at the Midwest Administration Center, University of Chicago.

Data were subjected to analysis of variance on the IBM 650 Computer. All tests of significance were F-tests.

Conclusions

1. State 4-H Club Leaders were fairly uniform in their perceptions of their programming role. This was true regardless of type of organization. For the most part, other respondents did not perceive the role uniformly.

2. There was more agreement on what the role should be than on what it was as actually performed.

3. Perceptions appeared to be associated with type of organization and with area of responsibility. However, inconsistencies in perceptions indicate that other factors may have influenced perceptions.

4. There was lack of understanding of the role and of who was responsible for communicating information regarding it.

5. The role was perceived to be related more to providing leadership for the entire staff in the youth phase of Extension's program (within the over-all scope of Extension) than to institutional determinants or to the individual needs of the person performing the role.

6. In terms of content of the role between the two types of organization, respondents differed most on the role's relationship to over-all Extension policies and objectives.

7. The relationship of expectations between leadership patterns and content areas were not always consistent.

8. State 4-H Club Leaders and other respondents generally differed regarding the relationship of their perceptions to the institutionally and personally-oriented leadership patterns.

9. This general approach to studying the programming role of the State 4-H Club Leader could be usefully employed in similar studies on the state basis.

10. The model and design was a useful means of studying the educational role of a position in an administrative organization.

Based on the findings of this study, it is recommended that each state Extension Service define: (1) the State 4-H Club Leader's programming role; (2) the nature of its essential relationships with other position groups; (3) where the position most logically fits in the organization; and (4) the desired relationship between program determination and program execution.

Microfilm \$3.10; Xerox \$10.80. 240 pages.

**ADMINISTRATIVE COMPETENCIES IN
CHRISTIAN DAY SCHOOLS**

(Order No. Mic 61-2367)

Walter Gilbert Fremont, Jr., Ed.D.
The Pennsylvania State University, 1961

Purpose: The purpose of this study was twofold: (1) to develop a basic set of general principles of administration. (2) to use them in evaluating the present administrative practices of Christian day schools affiliated with the National Association of Christian Schools.

Procedures: To accomplish the first purpose, the writer established twelve general principles of administration from ten sources of authority on administration which were approved by the committee. The principles are as follows:

1. A good school should have a promotion policy which allows promotion for all children who have made some progress in relation to their individual capacities.
2. A good school should have a reporting system which will give parents frequent information about the progress of their individual child's development so that they may cooperate with the school in promoting this development.
3. A good school should keep records concerning the child's physical welfare, mental ability and growth, and personality development; and these records are made available, properly interpreted, and used by all who work for the welfare of the child in the elementary school.
4. A school should have a scientific appraisal of pupil progress using both standardized intelligence and achievement tests which are properly interpreted to teachers, parents, and pupils.
5. A good school should have a staff composed of persons possessing the best personal qualifications, supported by adequate training and experience, and written personnel policies under which this staff can most effectively and efficiently work.
6. Each school should have an adequate salary schedule with regular increments for training and experience and a provision for sick leave.
7. A good school should have a continuous program of supervision with follow-up conferences, whereby teachers are helped with their problems of teaching, and instruction is improved.
8. A good school should have a continuous program of in-service education to help teachers grow professionally.
9. A good school should have and maintain a public relations program designed to bring about a harmony of understanding between the school and the public it serves.
10. A good school should have a budget which reflects and conditions the educational program and which requires an adequate income and cooperatively planned expenditures spent in the most economical way.

11. A good school should have a central library which supplies classroom collections when needed. There should be a regular amount of money per pupil set aside each year to buy library books and supplies.
12. A good school should have a board which determines and writes out general policies for the educational program and selects a competent administrator to be responsible for the functional administration of these policies and to act as counselor to the board in their policy-making function.

To accomplish the second purpose, the writer then used the above principles as a criteria in developing a questionnaire to determine the extent to which Christian day schools were using the principles in actual practice. The survey included responses from one hundred and seventeen schools located in thirty-three different States.

Conclusions: Five strengths and five weaknesses in the administration of Christian day schools were revealed by the data. The strengths are as follows:

1. The average Christian day school has a pupil teacher ratio of sixteen to one.
2. Eighty percent of the schools have complete cumulative records.
3. Seventy-six percent give intelligence tests and over eighty-seven percent give achievement tests.
4. Seventy percent of the schools have a thorough public relations program.
5. In seventy-seven percent of the responding schools the board takes its rightful place in determining the board policies.

The five weaknesses are as follows:

1. The inadequate financial base of the majority of the schools makes it necessary to look to donations for adequate monies.
2. Twenty-two percent of the Christian day school teachers do not have a bachelor's degree.
3. The majority of schools have a formal grade standard concept of the schools as evidenced by their promotion and report card practices.
4. Over forty percent of the schools lack a good program of supervision or in-service education.
5. In fifty-three percent of the schools the teachers do not participate in the preparation of the budget.

Microfilm \$2.75; Xerox \$6.00. 124 pages.

**HIGHER EDUCATION IN THE UNITED STATES
PERCEIVED AS A SOCIAL SYSTEM**

(Order No. Mic 61-2691)

Burton Dean Friedman, Ph.D.
Michigan State University, 1961

Major Professor: Karl T. Hereford

Reports on higher education in the United States demonstrate that each observer's (a) report and (b) frame of

reference are personal, i.e., expressive of unique individual perceptions. Any one observer's reports may be scrupulously objective and internally consistent. Collectively, their reports appear to be not only diverse but un-systematic.

Lack of systematization impedes study of higher education. Yet such study is urgently required because pressure to expand higher education is great and steadily increasing, and because higher education is becoming a major social and political concern of U. S. society. A consistent, "objective" frame of reference is needed by which to conceptualize higher education and in terms of which to collate diverse views regarding higher education.

The purpose of this thesis is to construct one objective frame of reference for studying higher education in the United States. The method is expository. The technic involves a logical blending of social system theory (with special reference to Loomis' model for social system analysis¹) and perceptual theory (with special reference to Bills' personality typology²).

Comprised of individuals who interact, higher education may be studied as interaction. The concept "social system" may be utilized to study interaction within higher education. Perceptual theory provides one "objective" system for interpreting individuals' diverse perceptions of higher education.

One systematic conceptualization of higher education is developed applying the concept "social system," perceptually viewed, to higher education. The conceptualization is (a) perceptual, (b) "objectively" systematic, and (c) comprehensive. It allows one to relate higher education with society.

Higher education in the United States is defined as the social system which emerges from and is comprised of patterns of interaction among members of colleges, universities, and related enterprises or associations within the United States. Each such component constitutes a subsystem comprised of lesser units, e.g., departments, research teams, fraternities, etc.

Individuals act in accordance with their perceptions of reality. Individuals' overlapping perceptions define "social reality," including a modal view of a social unit's situation, worth, and collaborative action. Social reality guides members' actions, creating a modal pattern of predictable "social action" characteristic of the social unit.

A perceptual typology is postulated. Predictions are made regarding four constructed types of social systems of higher education:

1. "Self-maximizing" colleges, departments, universities, etc., deem themselves and significant other social systems (e.g., comparable units, local community, etc.) "worthy." They assume neither present superiority nor inferiority. Accurate in perceiving social reality, they balance their interest in self and situation, hence are free to respond to situation. Not excessively concerned with winning recognition or demonstrating superiority, they can lead or follow other systems. They are well-integrated systems that enjoy: internal solidarity; effective communications; good communication of sentiment; capable tension management; rational decision-making and facility utilization; principled behavior by members, with broad tolerance for deviancy; and capacity for effective systemic linkage. They attempt to preserve, increase, disseminate, and apply knowledge in many areas.

2. "Self-perpetuating" systems assume present superiority. Hypo-accurate in perceiving reality, excessive interest in self and in the "good" status quo makes them oblivious to and unable to cope with external situation. Willing to lead or aggressively to dominate other systems, they are unable to follow. Having extreme integration and solidarity, they are relatively impervious to systemic linkage. They require uniform behavior by members, without tolerating deviancy.

The disseminating of specified knowledge is the prime academic concern. This is the modal pattern in U. S. higher education in (a) departments within a college, (b) non-departmentalized and self-contained colleges, and (c) multi-college universities.

3. "Self-minimizing" systems assume present inferiority. Hence, despite hyper-accurate perceptions, they lack confidence, are unable to reach decisions, perceive too many problems, and are disposed to follow other systems (which they aim to please). Lacking integration and solidarity, they are highly permeable but unable to effect desired systemic linkage. Having little agreement on principle, virtually all individual behavior is deviant, hence legalistic social controls predominate. Effort is dispersed, resulting in "smorgasbord" curricula and extensive but ineffective facility utilization. This describes "higher education in the United States."

4. "Self-less" or "apathetic" systems assume their own and others' inferiority. Hypo-accurate in perceiving reality, they are unwilling followers, unable to lead, threatened by external situation, isolated, tradition-bound, and impermeable to systemic linkage, but subject to authoritarian control.

Apparently diverse views of higher education are reconciled within the frame of reference provided by this conceptualization.

1. Charles P. Loomis, Social Systems (Princeton: D. Van Nostrand Company, Inc., 1960.)

2. Robert E. Bills, "About People and Teaching," Bulletin of the Bureau of School Service, Vol. 28 (December, 1955), College of Education, University of Kentucky, Lexington, Ky. Microfilm \$3.50; Xerox \$12.15. 270 pages.

A MULTI-PERCEPTUAL STUDY OF CENTRAL STAFF EXPECTATIONS AND PERFORMANCES IN SELECTED IOWA SCHOOL SYSTEMS WITH ENROLMENTS BETWEEN 2,000 AND 25,000

(Order No. Mic 60-5659)

Norman Scott Green, Ph.D.
State University of Iowa, 1960

Chairman: Associate Professor S. J. Knezevich

The existing definitions of central staff, along with the determination of its relationship to other components of the administrative organization in public education, have lacked the clarity necessary for complete understanding of the concept. A review of the historical development of the central staff in educational administration was necessary

to develop an appropriate definition for the staff function in a school system in order to identify the role of the central staff. This definition is stated as follows:

The Central Staff person is one who represents an extension of the influence, personality, and frequently the authority of the superintendent (organization head). He performs functions which the chief executive would perform himself if he had the time and/or specialized knowledge. The staff person assists in planning and/or supervising the activity of others. These people are usually thought of as being part of "superintendent's office" or "central office."

The significance of research in the areas of role analysis and group expectation is suggested by writers in the field of administration as well as authorities studying group behavior and achievement. Such writers have maintained that successful performance of administrative and supervisory tasks will, in great measure, be affected by the degree of understanding of role relationships prevailing among members of the organization. It was expected that this study would provide further insights into the role of the central staff through the development of a definition of the central staff, its role, and problems relating to its operation in the over-all administration of the school system.

This study was undertaken to determine the degree of consensus on the role of the central staff existing between and within the various referent groups in a sample of sixteen selected Iowa school systems with enrolments ranging from 2,000 to 25,000 pupils. These referent groups included board members, superintendents, principals, and central staff members. Degrees of consensus were determined on questions relating to "expectations" for responsibility and appraisal of performance of the central staff for selected functions or services. Also examined were the superintendent's perceptions of these "expectations" and appraisals of performance.

The personal interview technique was used to gather data on the school systems and on the expectations for responsibility and appraisals of performance of the central staff. The interview instrument included a list of sixty-three items submitted in the study as being among the constellation of tasks which the central staff might be expected to perform.

A description of a "mythical" system describing the average or median conditions obtaining throughout the sixteen systems was presented. The average administrative organization in this sample was not fully clear. Neither organization charts nor job descriptions existed for administrative personnel. The superintendent experienced difficulty in describing his organization, sometimes using position titles which were inadequate to describe the functions being performed by the position incumbent. Staff members also displayed a lack of understanding of administrative relationships.

Findings relating to the "expectations" and appraisals of performance for the central staff indicated that a large number and variety of positions were thought by referent groups in the sample to be lacking. The smaller school systems reported a greater proportion of such needs than did the larger systems and, at the same time, reported the fewest additions to their central staff since the end of World War II. Although considerable disagreement was reported as to what central staff positions or services were

lacking, indexes of consensus were shown to be high in most instances where referent groups indicated what responsibilities they "expected" the central staff to assume. These findings, combined with the fact that administrative relationships were not clear, implied that while school staff personnel appeared to be in general agreement regarding the role of the central staff, they did not know enough about their own organization to agree on central staff personnel needs or to mutually confirm administrative relationships. This suggests that chief administrators might well profit from more carefully defined organization charts and job descriptions, with considerable discussion being given to both of these devices at staff meetings.

The role of the central staff was viewed by referent groups as including the following functions or services listed in order of the extent of responsibility "expected" to be assumed by the central staff.

1. Providing assistance with, and direction of, affairs of business management and finance. (Almost complete)
2. Conducting research and preparing records and reports. (Almost complete)
3. Supervision and direction of auxiliary and non-instructional services. (Almost complete - moderate amount)
4. Planning, coordinating, and directing public relations activities. (Moderate amount - almost complete)
5. Directing and coordinating certificated and non-certificated personnel services. (Moderate amount - almost complete)
6. Providing assistance and direction to professional staff in the areas of curriculum and instruction. (Moderate amount)
7. Controlling and directing pupil personnel services. (Moderate amount - little)

Microfilm \$3.90; Xerox \$13.75. 301 pages.

PLANNING THE SCHOOL OF EDUCATION IN AN EXPANDING SEATTLE UNIVERSITY

(Order No. Mic 61-1011)

George Francis Keough, Ed.D.
Stanford University, 1961

The problem was to determine whether the University and its School of Education should expand to meet the demands of future college applicants. The purpose of this study was to provide the empirical basis for the decision. It was proposed that this be done in four steps:

1. To develop a method of analyzing and projecting university enrollments.
2. To determine the effect enrollment would have on University space, curriculum, faculty, finance, services, and facilities.
3. To derive School of Education enrollment estimates.
4. To determine what demands they might make on the University space and finance and what effect they

might have on School of Education faculty, curriculum, facilities, and services.

The methodology formulated for this study was based on the hypothesis that the student population of Seattle University could be divided into sub-populations described by the combination of the factors of sex, religion, veteran status and type and location of former high school; that the past enrollment increases could be accounted for in terms of the numerical fluctuations of these sub-populations and that the numerical fluctuations would reveal trends which could be used as a basis for estimating future enrollments. It was necessary to assume that the trends which were identified would persist. Adoption of this hypothesis led to the establishment of twenty-four logical categories such as "Catholic women from local Catholic high schools" or "Non-Catholic veteran men from distant public high schools." Tracing these groups from 1954 to 1958 did reveal certain consistent trends. Most significantly it disclosed the fact that practically all of the enrollment increases of the University could be accounted for by the increase of two groups, Catholic women from distant Catholic high schools and Catholic women from distant public high schools, both from outside the metropolitan area.

The projections of University and School of Education enrollments were obtained by:

1. Establishing a regression equation describing the quantitative trend of each substantial sub-population of the freshmen classes for the years 1951 to 1958 and projecting it to 1970.
2. Calculating an average survival factor for former sophomore, junior, and senior classes and applying it to the freshmen projections.
3. Deriving an average School of Education percentage factor for the past years and applying it to the University projections.

The total number of students enrolled in each professional education course from 1954 to 1958 was reduced to a decimal equivalent of the total number of education majors for those years. The factor for each course was applied to the School of Education enrollments for the years in the projection. The resulting number of students was divided into classes, whose size had been determined by the joint opinion of teachers and administrators. The classes were scheduled over the three academic quarters of each year in the projection, and from this distribution annual and quarterly instructor hours were calculated; classrooms and student stations were determined; and counseling and administrative loads estimated. Requirements in terms of space, facilities, and finance were estimated, and balanced against resources in those fields.

University and School of Education income and expenditures for the period of the study were analyzed and projected.

It was concluded that with minor tuition adjustments both the University and the School of Education would be able to provide faculty, classrooms and facilities for the enrollment increases contemplated in the study.

Microfilm \$2.75; Xerox \$9.25. 202 pages.

A COMPARISON OF TEST PERFORMANCE AND CURRENT STATUS OF ADMINISTRATIVE CANDIDATES IN TWENTY-FOUR SCHOOL DISTRICTS

(Order No. Mic 61-1013)

Robert Burkland Moore, Ed.D.
Stanford University, 1961

Statement of the Problem

The Regional Center of the Cooperative Program in Educational Administration at Stanford University has used a series of psychological tests to aid school districts in selecting school administrators. In a three year period, 1954 through 1957, five hundred ninety-nine administrative candidates from twenty-four districts participated in the testing program. Selected sub-groups from this sample were used in this study.

It was assumed that the extent to which the testing procedures affected the selection of administrative candidates in the districts could be judged on the basis of the degree to which selected sub-groups performed differently on the tests. A finding that the groups did differ, and that those differences were consistent with criteria assumed in the selection procedures would indicate that participation in the Stanford CPEA program led to improved selection procedures.

Three hypotheses were tested:

1. That when the administrative candidates within the sample were grouped by status and their test scores then compared, significant differences among the groups would be found.
2. That when the administrative candidates within the sample were grouped by job-title and their test scores then compared, significant differences among the groups would be found.
3. That when administrators within the sample were grouped by type of district and their test scores compared, significant differences would be found.

The testing of these hypotheses resulted in a three-phased study which dealt with comparisons of candidates by status, job-title, and, in the case of administrators, by type of district.

Scores of the administrative candidates on the Miller Analogies Test, the Allport-Vernon-Lindzey Study of Values, the Minnesota Teacher Attitude Inventory, the Public Opinion Questionnaire (F Scale), and the Edwards Personal Preference Schedule were used.

Procedures

A questionnaire completed by district superintendents provided information for the status of candidate phase. Six sub-groupings were made: (1) administrator prior to testing; (2) became administrator in district following testing; (3) still considered for administrative position; (4) no longer considered for administrative position; (5) became administrator in new district; and (6) left district - no information.

In the job-title phase, groupings were made from data supplied in a job-title questionnaire completed by candidates. This information was supplemented by a search of

district directories. The sub-groups were: (1) vice-principal, (2) principal, (3) supervisor, (4) counselor, (5) dean, (6) assistant superintendent, (7) director of personnel, and (8) classroom teacher.

For the third phase which compared administrators, districts with common administration from grades 1-12 were classified as unified districts, and districts with common administration from grades 1-8 were classified as elementary districts.

An analysis of variance procedure was used and differences below the .05 level were considered significant. "t tests" were used to provide a measure of the significance of particular differences.

Results

Statistically significant differences between groups were found in each phase of the study.

The Miller Analogies Test and the Public Opinion Questionnaire (F Scale) differentiated significantly in each phase. The Minnesota Teacher Attitude Inventory differentiated significantly in the status of candidate and job-title analyses. The Edwards Personal Preference Schedule needs variables of "autonomy," "aggression," "exhibition," "deference," and "affiliation" differentiated significantly in one or more phases.

Conclusions

Differences in test performance did exist among various classifications of a sample of those who had participated in the initial selection procedures intended for use with administrative candidates. In the status of candidate grouping, which was the major phase of the study, the various groups performed in a manner consistent with the implicit criteria of selection and rejection of candidates for administration positions, and it appeared that selection procedures in the participating school districts were improved as a result of the Stanford CPEA program.

Microfilm \$2.80; Xerox \$9.70. 213 pages.

SELECTED CHARACTERISTICS AND PROBLEMS OF MARRIED STUDENTS AT THE UNIVERSITY OF OKLAHOMA

(Order No. 61-2904)

John Richard Murray, Ed.D.
The University of Oklahoma, 1961

Major Professor: Claude Kelley

Since the close of World War II, the number of married students enrolled in colleges and universities has greatly increased. Partial depletion of veterans benefits has not substantially affected the proportion of such students on campuses. Enrollment figures indicate that married students constitute from twenty to thirty-five per cent of the total students enrolled in institutions of higher education. It is the purpose of this study to describe the characteristics and problems of married students at the University of Oklahoma. A questionnaire and a modified Mooney Problem Check List were sent to a random, stratified

sample of one-third of the 1112 married resident students of the University of Oklahoma. Returns were received from two-thirds of the undergraduate sample and three-fourths of the graduate sample.

Summary of Findings:

The undergraduate subjects were primarily non-veteran, advanced students who married while in college.

The graduate subjects were usually first-year graduate students, veterans, and had married after completing a baccalaureate degree.

The majority of both groups was male, had children, lived in non-university housing, and resided in Norman, Oklahoma, more than ten months per year.

The majority of the subjects came from middle or upper-middle class homes. Most of their parents had completed high school and many had completed four or more years of college.

The primary sources of income were earnings of spouse, aid from relatives, students' earnings, and personal savings. Veterans benefits were listed by only one-third of the group.

The areas in which the greatest number of problems were listed were social and recreational activities, adjustment to college, curriculum and teaching, and finance. More than ninety per cent of the students believed the check list depicted their problems.

Most of the facilities and services provided married students by the University of Oklahoma were described as adequate by the subjects. Those considered inadequate were temporary facilities.

Acceptance of conditions which necessitate acceptance of financial aid from parents was evident. Few students opposed the acceptance of such aid. Neither male or female students indicated opposition to the wife working outside the home while the mate was a student.

Major Conclusions:

1. Further changes in the characteristics of married student groups can be expected. Comparison of the findings of this study with others indicate the changing nature of such groups.
2. Some of the problems indicated are to be expected among young married couples. Some are unique with married students.
3. Careful planning with regard to married students is needed. Their differences indicate that their needs are such that special arrangements for them are essential.

Recommendations:

1. The feasibility of educative experiences in the areas of family finance, marriage, counseling, and child care should be investigated.
2. Expansion of nursery school facilities should be considered. The direction of this service by an appropriate academic department could be profitable for the department and the children.
3. Housing, recreational space for children and parents, and a well defined relationship between married students and the institution are needed.

Microfilm \$2.75; Xerox \$6.60. 139 pages.

**RELATIONSHIPS BETWEEN STATE
LEGAL PROVISIONS AND
SCHOOL-COMMUNITY INTERACTION**

(Order No. Mic 61-1012)

Dwight Hillis Newell, Ed.D.
Stanford University, 1961

The thesis that state legal provisions under which school districts in the nation operate are related to the financial support of schools as shown in successful results of school bond and tax elections is proposed and tested. State legal provisions in this study are: 1) those which govern the selection and composition of school board members, and 2) those which govern school district fiscal activity. A description of the above relationships should prove useful in analyzing a crucial problem in school administration, school-community interaction.

Method of the Study. Characteristics of state legal provisions were ordered and classified by using United States Office of Education reports as guides. Provisions controlling school board membership are: selection by appointment or election, terms of office, size of boards, time required to change a majority of the members, nomination procedures, geographical areas of representation, kinds of elections, and filling interim vacancies on the boards. Controls on school district fiscal activity are: proportions of state and local funds expended on public education at the local district level, procedure for adopting the local budget, procedure for the initiation of school bond proposals, and the number of elections for miscellaneous financial purposes.

A questionnaire designed to obtain information on the operation of the legal provisions and collect data on an eleven year (1948-1959) history of bond and tax elections was mailed to a disproportionate, stratified probability sample of 1054 districts in forty-eight states. Districts were categorized as: Large, over 12,000 attendance; Medium, 3,000 to 11,999; Small, 150 to 2,999. The sample was drawn by the United States Bureau of the Census from 1957 records. Eighty-two per cent of the sample responded.

The null hypothesis that each of the legal characteristics is not significantly related to success in school-community relations, controlling for district size and type of election, was tested. The chi square statistic was used for evaluating relationships. Those relationships in which the p is calculated to be .05 or less are considered to be significant in this study.

The Findings. The major thesis of the study was confirmed. Characteristics, however, were not found to operate uniformly in bond and tax elections or in districts according to size.

Significant relationships in successful bond elections are: kinds of elections held for board members, proportions of state and local funds in local budgets, and the number of elections for miscellaneous fiscal purposes. Significant relationships in successful tax elections are: length of term for board members, time needed to change a majority of the board, nomination procedures for board members, and proportions of state and local funds in local budgets.

The manner in which these characteristics operate makes a dichotomy between districts according to size. Successful outcomes of financial elections in small districts appear to be oriented to legal provisions which insure the electorate a wide opportunity to make policy decisions by voting. Large districts (medium size districts to a lesser extent) appear to be oriented to legal provisions which insure a greater degree of stability, autonomy, and insularity from direct community involvement.

Further Study. A differentiation in campaigning techniques for bond elections and tax elections is suggested as a result of this study. The possibility that different dimensions in administrative leadership and communications are operating in large districts and in small districts for successful school-community interaction is also suggested.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

**TEACHERS' OPINIONS REGARDING MERIT
RATING AS RELATED TO CERTAIN
PERSONAL AND SITUATIONAL FACTORS**

(Order No. 61-2974)

James Otto Reiels, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Russell T. Gregg

I. STATEMENT OF THE PROBLEM

This research was designed to analyze teachers' opinions regarding selected merit rating principles and practices by which salaries are determined. The opinions were studied in terms of faculty groups, personal factors of teachers, and factors inherent in school situations, in order to determine relationships between the opinions which teachers expressed and the factors related to themselves and to school situations.

II. PROCEDURE

The data in this study were furnished by two research instruments. One was a questionnaire which was sent to administrators in Wisconsin high school districts which had some form of merit rating as a part of their salary programs. In terms of this information, ten schools were selected for inclusion in the study. The questionnaire also furnished information about the merit programs and how they affected teachers' salaries. The second instrument furnished personal information about teachers, as well as their opinions about selected merit rating principles and practices. Opinions were obtained about problems concerning the feasibility, effects, evaluation, and implementation of merit rating programs. Within these four major problems were thirteen sub-problems for which mean scores and standard deviations were computed. Teachers' opinions regarding these sub-problems were classified according to faculty groups and according to sixteen personal factors and nine situational factors. When teachers' opinions were so classified, differences in mean scores indicated relationships between the expressed opinions and the selected factors.

III. RESULTS

The findings of this study indicate that certain personal factors, especially those related to teaching assignments, are related to the opinions which teachers expressed regarding merit rating. The findings also indicate that the opinions which teachers expressed regarding the problems of feasibility, evaluation, and implementation of merit rating programs differed among the faculty groups. On the other hand, the opinions regarding the effects of merit rating on teacher morale, professionalism, self-improvement, quality of teaching, and administrator-faculty relationships did not differ among the groups.

IV. CONCLUSIONS

The following conclusions are justified. The opinions which teachers express regarding merit rating principles and practices: 1) can be determined and objectively analyzed; 2) vary among faculty groups; 3) vary from one merit rating problem to another, and are not entirely favorable or unfavorable toward all aspects of merit rating; 4) differ less within faculty groups than when they are classified according to personal or situational factors; 5) are related in varying degrees to most of the personal and situational factors included in the study; and 6) are more closely related to factors inherent in school systems than to those related in individuals.

Microfilm \$3.20; Xerox \$11.25. 247 pages.

AN APPRAISAL OF FEDERAL ASSISTANCE FOR EDUCATING CHILDREN IN LOCALITIES AFFECTED BY FEDERAL ACTIVITIES: PUBLIC LAW 815 AND PUBLIC LAW 874.

(Order No. Mic 61-2342)

William Simmons, Ed.D.
Wayne State University, 1961

Adviser: W. Ray Smittle

This dissertation is delimited to a study of the historical, economic, and operational factors embodied in Public Laws 815 and 874. These two laws provide federal financial assistance to local school districts operating in federally affected areas. The primary purposes of the study are: To review the history of Public Laws 815 and 874; to report the attitudes of national organizations interested in educational legislative activities toward Public Laws 815 and 874; to report the results of a nationwide survey of the attitude of school administrators employed in districts participating in this federal support program; to analyze the factors that determine eligibility for construction grants under Public Law 815 in selected Michigan school districts; and to make recommendations in regard to Public Laws 815 and 874 toward improving existing legislation, formulating a permanent legislative program, and undertaking a continuous study program.

The descriptive method of research is employed. Documentary and informational analysis provide basic data. Two questionnaires are reported and analyzed. The attitudes of national organizations which maintain an active

educational lobby in Washington, D. C., toward Public Laws 815 and 874 are reported through letters and policy statements.

The conclusions reached are considered in terms of the purposes enumerated in Public Laws 815 and 874: The federal government has a direct obligation to provide financial assistance to local communities impacted by the activities of the federal government either directly or indirectly; federal responsibility to impacted school districts can be provided for in the form of direct money grants without compromising state and local control of public education; the federal funds allocated to local school districts under Public Laws 815 and 874 are offered as supplemental aid, not as a substitute for revenues that can be provided from state and local sources; the administrative program designed to implement Public Laws 815 and 874 has strengthened the role of state educational agencies by designating such agencies as advisory and reviewing authorities; the cooperative efforts of the federal and state agencies have assured the equitable establishment of rates under Public Laws 815 and 874; the United States Office of Education can administer federal educational programs more efficiently and effectively than any other agency of government; federal payments to local school districts under Public Laws 815 and 874 are more equitable than a program of payments in lieu of taxes because of the variation in local assessment practices; the duration of federal impact on a local school district has not been adequately determined; and the yearly expansion of the program of assistance under Public Laws 815 and 874 indicates that the laws should be made permanent.

The following recommendations are made: Public Laws 815 and 874 should be made permanent legislation; pupil eligibility categories in Public Law 874 should be revised to agree with pupil eligibility categories in Public Law 815; the present separate application forms for Public Laws 815 and 874 should be combined into a single simplified form; a manual of instruction to applicant school districts under Public Laws 815 and 874 should be prepared by the United States Office of Education; state educational agencies should be given an approval role in the processing procedure; federal payments under Public Laws 815 and 874 should be supplemental to state and local revenues; federal payments should be continued for three years following initial eligibility on a descending scale, regardless of declining pupil membership; the absorption percentage requirement in all categories of federal pupils should be removed from Public Law 815 and Public Law 874; eligibility requirements should be based on federal pupil increases rather than on increases in federal membership and total membership; and rate of payments under Public Laws 815 and 874 should be continuously studied to assure adequate support program.

Microfilm \$5.45; Xerox \$19.35. 427 pages.

AN ANALYSIS OF THE TRANSITION FROM THE JUNIOR COLLEGE PROGRAM TO THAT OF A FOUR-YEAR LIBERAL ARTS INSTITUTION AT SPRING ARBOR JUNIOR COLLEGE

(Order No. Mic 61-2717)

Roderick Jackson Smith, Ed.D.
Michigan State University, 1961

Major Professor: William H. Roe

The Problem

The primary objective of this study is to identify the general problems encountered by an institution during the period of transition from the junior college program to that of the four-year liberal arts institution. A secondary objective is to relate these problems in a direct way to Spring Arbor Junior College with recommendations that will implement a successful transition.

An immediate problem became apparent when a diligent search of literature failed to reveal any significant writings in the area of transitional problems. This obviously became the kernel of research which became interwoven with the main objectives, the search for a clear identification of these problems.

No attempt is made to determine the reasons or validity for making the change of college organization. The study is limited to the transition from the junior college program to that of the four-year liberal arts institution.

Methodology

The methods and techniques used in this study are; a search and utilization of literature which is pertinent to the problem, a selection of colleges to be used as case studies, preparation for structured interview with an administrator at each college, review of Self-Study Reports of each college visited, review of Self-Study Reports of other colleges having accomplished this specific transition but not visited, and a general analysis of this information in a summary form.

Conclusions

The following conclusions are drawn from the results of the findings of this study:

1. The methods most generally accepted as usable for identifying internal problems are; self-study reports, faculty committees, cooperation with accrediting agencies, state agencies for higher education, state universities and centers for higher education, and special consultants.
2. The group of problems clearly defined as being common to institutions during the period of transition from the junior college program to the four-year liberal arts institution are; curriculum, faculty, finance, facilities, students, and institutional purposes.
3. The transition from the junior college program to the four-year liberal arts program is both possible and reasonable. The needs of higher education provide an incentive for this expansion, and the record of several institutions in the past decade attest to the feasibility.

Recommendations

1. A master plan of curriculum development should be prepared which identifies the basis upon which the academic program of the four-year liberal arts college is established.
2. All available sources of assistance should be utilized in developing the new college concept. These should include: self-evaluation processes, faculty committees, cooperation with accrediting agencies and other units of higher education, and professional consultants.
3. Utilization of methods and techniques can result in increased effectiveness and efficiency. These might include television, teaching machines, larger class size, honors programs, and independent study.
4. Staff may be strengthened by addition of instructional personnel giving evidence of outstanding scholarly attributes, and potential for continued contribution to the college.
5. Long range planning should include the whole area of faculty welfare, both physical and philosophical. Such items as salary, promotion, retirement, insurance, and other conditions of employment are essential to happy and effective service.
6. A long range program of admissions and student clientele should be developed by the faculty and administration.
7. The Master Plan of Campus Development should be kept current with a process of re-evaluation as each step is completed.
8. Consideration must be given to the financial program, both in terms of present and future needs. Care must be exercised that operational and capital funds are not competing with each other.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

A STUDY TO DETERMINE THE ACCURACY WITH WHICH SELECTED SECONDARY SCHOOL PRINCIPALS PERCEIVE THE ROLE EXPECTATIONS HELD FOR THEM BY THEIR STAFF AND SUPERINTENDENT

(Order No. Mic 61-2343)

Frederick D. Thorin, Ed.D.
Wayne State University, 1961

Adviser: Roland C. Faunce

This study attempts to determine the principals' awareness of the role concepts held for them by their staffs and their superintendents of schools. In addition to determining how the principal, superintendent, and staff believe that a principal should "ideally" behave, it is important to understand how they believe he "actually" behaves. A knowledge of the principal's "ideal" and "actual" behavior provided the opportunity to examine the relationship which existed between each individual's "ideal" and "actual" concept of the principal's role. An additional analysis was also made of the "ideal" and "actual"

concepts held by each group from the various schools studied.

An additional phase of the study was to determine how aware the principal is of the percentage of time that his staff and superintendent believe he should devote to his three major areas of responsibility: Administration, Public Relations, and Curriculum.

The design of this study required the development of four instruments. Each was designed around illustrative examples of the expectancies held for the principal by his superior and subordinates. The illustrative examples were ranked in order of importance by each principal, his superintendent, and staff. In addition, the principals were asked to rank the same illustrative examples in the same order that their staff and superintendent had ranked them. In other words, the principals were asked to perceive the expectations held for them by their staff and superintendent.

The analysis of rank scores was computed after each teacher, principal, and superintendent had completed his questionnaire. This analysis was attempted from several perspectives. First, the rank scores were examined to determine the degree of correlation that existed among them. Secondly, the rank scores were shown graphically, accompanied by a verbal description of the graphs. Finally, statistical inference was utilized to ascertain whether the differences in rank scores were statistically significant.

The data collected supported the following major conclusions:

1. The principal does not have an accurate perception of the total role concept held for him by his staff and his superintendent.
2. The greatest amount of agreement as to the concept of the principal's "ideal" role was found to exist between the staff and the superintendent.
3. Closer agreement exists between the principal and his staff than exists between the principal and his superintendent as to the concept of the principal's "ideal" role.
4. The staff is critical of the fact that they believe the principal is placing less "actual" emphasis on his curricular functions and too much "actual" emphasis on his public relations and administrative functions.
5. The principal believes that he is not placing enough "actual" emphasis on his curricular functions and too much "actual" emphasis on his public relations functions.
6. The superintendent is less critical of the emphasis that the principal is "actually" placing on his functions than is the staff or the principal.
7. When the principal accurately perceives the role concept held for him by his staff and superintendent, he more closely fulfills their "ideal" role concept.
8. A greater amount of agreement exists between the principal, staff, and superintendent in relation to their concept of the principal's "ideal" role than exists between their concept of the "ideal" percentage of time that should be devoted to the implementing of these functions.

Microfilm \$2.75; Xerox \$7.60. 165 pages.

A STUDY OF THE RELATIONSHIPS BETWEEN THE BOARD OF EDUCATION AND THE RECREATIONAL AGENCIES OF JERSEY CITY

(Order No. Mic 61-2578)

Gaetano Ralph Trapanese, Ed.D.
New York University, 1961

The profound social changes, the scientific discoveries, and the technological progress witnessed in the twentieth century have created new and challenging situations for mankind. A direct result of this advancement has been more leisure time and a greater desire for organized recreational activities.

To meet the leisure time goals of the community, cooperative planning among the various groups is essential.

An agency which can contribute much to the success of the recreation program of the community is the board of education. It can exercise a significant role because of its unique position. It can do so by making recreation part of its instruction program, by making available its facilities for recreation purpose, and by assuming leadership through its trained personnel.

The purpose of this study was to determine what cooperation should exist between the board of education and the voluntary youth serving agencies.

The areas covered by this study were: 1. To describe the recreational functions performed by the board of education and the community serving agencies. 2. To identify the current practices which exist in similar community situations. 3. To establish operational principles for effective cooperation between the agencies serving the recreational needs of youth. 4. To develop a plan for the improvement of the relationship between the board of education and the youth serving agencies.

To solve these sub-problems, several methods of research were used, namely, personal interviews, questionnaires, and inspection of the literature. In addition to these, the investigator examined program announcements, annual reports of the local agencies and their national offices, and the minutes of the board of education.

In order to offer some practical guidance to administrators of education and recreation, the results of the above investigation and further literature research were incorporated in statements of validated principles.

Established facts and findings of this study support the following recommendations:

Organization and Administration

The board of education should: 1. Take the lead in co-ordinating the youth program of the community. 2. Formulate definite policies which will guide the board of education in dealing with the voluntary agencies.

Program

The board of Education should: 1. Set-up a consultative service to aid voluntary recreation agencies. 2. Strive for community recreation program which will meet the needs of youth. 3. Advocate a flexible program to meet the changing needs of the community. 4. Complement the program of the voluntary agencies.

Public Relations

The board of education should: 1. Cooperate with the voluntary agencies in publicizing the recreational opportunities in the community. 2. Assist in creating favorable opinion about the agencies' program.

Leadership

The board of education should: 1. Establish in-service programs to insure qualified leaders. 2. Open these programs to all the recreation leaders of the community. 3. Train volunteer workers to secure capable leaders. 4. Whenever possible, share its personnel with the voluntary agencies.

Research

The board of education should: 1. Encourage the community agencies to use scientific data for changes in the program. 2. Cooperate in research projects. 3. Make available to all those concerned its data on recreation.

Facilities

The board of education should: 1. Plan and construct future schools for education-recreation purposes. 2. Encourage greater use of existing facilities by community groups. 3. Play a role in future community planning.

Cooperation

The board of education should: 1. Plan cooperatively with the voluntary agencies. 2. Assume leadership in supplying services to meet the needs of youth. 3. Encourage community groups to work together for the welfare of the community.

It is the sincere hope of the investigator that the findings may strengthen the cooperation between the various agencies serving the needs of youth.

Microfilm \$2.75; Xerox \$9.45. 207 pages.

AN EVALUATION OF THE HAZEL PARK YOUTH PROTECTION COMMITTEE APPROACH TO THE JUVENILE DELINQUENCY PROBLEM

(Order No. Mic 61-2345)

Wilfred Dwight Webb, Ed.D.
Wayne State University, 1961

Adviser: Roland C. Faunce

The Hazel Park Youth Protection Committee Program is an effort on the part of a group of citizens to help prevent delinquency and assist individual children with emo-

tional and behavior problems. The committee, created by city ordinance, meets regularly twice a month to consider cases involving anti-social behavior, school difficulty, problems within the home, emotional maladjustment, and other difficulties. These cases are referred by the police, school, parents, or individuals in the community and the committee makes efforts to enlist the cooperation of the parents and the child in planning steps toward the child's adjustment. Although the members of the committee are volunteer citizens, there is a professional staff composed of a social worker and psychologist who have preliminary interviews with the child and the parents and carry on treatment programs with those that need it.

The purpose of this study is to determine whether or not the Youth Protection Committee is achieving its purpose of preventing juvenile delinquency on a local level.

These five main methods were used in the study.

1. Comparison of the juvenile delinquency rate trend in Hazel Park with that of two neighboring communities during the years 1952-1958, inclusive
2. Study of juvenile court referrals from Hazel Park as compared to the rest of Oakland County during the years 1952-1958, inclusive
3. Follow-up study of individual juveniles treated by the committee during the year 1954
4. Study of posttreatment recidivism of children served during the years 1953-1958, inclusive
5. Opinion survey of people in the community concerning the effectiveness of the program

The results of the study indicate that the trend of the offense rate in Hazel Park during the years 1952-1958 inclusive was downward at the rate of .134 each year. The study shows that the number of referrals from Hazel Park to juvenile court was reduced over 30 per cent during the period 1952-1958, inclusive. During this same period, Oakland County as a whole had an increase in referrals to juvenile court of over 85 per cent.

In an effort to determine the social adjustment of the 37 children treated in 1954 after their termination of contacts with the Youth Protection Committee the following areas of social adjustment were studied: religious participation, marital adjustment, employment adjustment, participation in recreational activities, school adjustment, plans for the future and delinquent behavior during and after contacts with the Youth Protection Committee. The results showed that a large majority of the youth referred to the Youth Protection Committee in 1954, when studied in 1958, had made a satisfactory adjustment in all areas considered.

The posttreatment recidivism study indicated the effectiveness of the Youth Protection Committee service in that only 31 per cent of the 342 cases handled from 1953-1958 inclusive recidivated. This is based on the juvenile and adult court records and it is possible that there were other offenses that did not reach court. Nevertheless, this seems like a favorable indication.

The survey made of citizens in the community demonstrated the high regard that the community has for the

work of the Youth Protection Committee. Seventy-one per cent of the questionnaires sent out were completed and returned. Almost all of the people surveyed expressed the feeling that the committee is doing an effective job for children and youth in Hazel Park.

The results of this study strongly indicate that the Hazel Park Youth Protection Committee is achieving its objective of providing individualized services to meet the emotional, social, physical, and educational needs of the children of the community, and by so doing, has been instrumental in preventing delinquency in the community. The specific recommendations for improving the program included in the study should be helpful to the Youth Protection Committee in planning for the future.

Microfilm \$2.75; Xerox \$9.00. 196 pages.

MATCHING NEEDS AND FACILITIES FOR HIGHER EDUCATION IN CANTON

(Order No. Mic 61-2806)

John Pennington Williams, Ph.D.
University of Michigan, 1961

The purpose of this study is to determine the felt needs and attitudes of high school seniors of Canton, Ohio, with regard to continuing their education beyond high school, with a view to estimating the extent to which these needs might be met by each of three types of institutions of higher education, if existing as the only institution of higher education in Canton. Such institutional variables as curriculum, control, tuition cost, and religious emphasis are used as points of analysis in the course of assessing data provided by the questionnaire inventory.

The three different types of institutions selected, around which to marshal data, may be defined briefly as:

1. The "municipal university," a public multiple-unit, complex institution, which includes four-year programs.
2. The public "community college," typically a two-year institution, emphasizing terminal education and general education, while also including adult education and college-parallel courses of study.
3. The church-related four-year "liberal arts college," with special reference to a Protestant church-related college.

The importance of the problem arises from the fact that in 1957 Canton was the largest metropolitan district of the nation without a degree-granting collegiate institution.

A questionnaire instrument was projected, in part, from mental models of the three alternative types of collegiate institutions just described. A trial form was tested

by use with a class of seniors in North Canton High School, just outside the "inventory zone." Usable questionnaire forms of the final lithographed instrument captioned "Let the Seniors Speak!" were returned by 1362 seniors (97.3%) of the 1400 seniors enrolled in their last semester of schooling in six high schools of the Canton area.

It is estimated that the curriculums of a community college might serve 440 seniors; of a municipal university, 311 seniors; and of a liberal arts college, 132 seniors. It is projected that a total of from 325 to 345 seniors would enroll in a community college; from 250 to 265 in a municipal university; and approximately 85 in a liberal arts college.

It is concluded that, in planning for Canton's future in higher education, attention ought not be focused upon the facilities and services of a single institution. Developmental tasks of the next decade should include:

1. Strengthening existing institutions.
2. Minimizing present inequalities.
3. Coordinating diversified facilities.

The inventory of the felt needs of seniors--as set against the envisioned curriculums of Canton's existing and planned facilities--suggests the need for public institution charging low tuitions and exercising a relatively liberal admissions policy. It is proposed that a technical institute, by placing strong emphasis upon the terminal and occupational curriculums that are engineering-related, could serve Canton as a "community college" in certain areas of greatest need.

There are evidences that Canton now needs a Commission on Higher Education in order to coordinate planning among the existing private and public agencies providing higher education for the area.

Microfilm \$3.00; Xerox \$10.35. 230 pages.

EDUCATION, HISTORY

A HISTORICAL ANALYSIS OF THE SOCIO-CULTURAL FACTORS THAT INFLUENCED THE DEVELOPMENT OF CAMPING EDUCATION

(Order No. Mic 61-2370)

Donald Robert Hammerman, Ed.D.
The Pennsylvania State University, 1961

STATEMENT OF THE PROBLEM

What socio-cultural forces were operating during the period 1930--1960 which either contributed to the inception

of the camping education idea, or influenced its development? The major objective was to examine basic socio-cultural forces that influenced the development of camping education. Subsidiary objectives were: (1) to document the rise and development of camping education, (2) to trace transitional patterns and establish significant trends through which camping education progressed, and (3) to assess the current status of school camping and explore the question of what should be its ultimate role in education.

METHOD OF RESEARCH

The synthetic, or eclectic theory of historical interpretation was employed in treating the problem. This theory maintains that historical developments of any age are dependent upon multiple causal factors of which the collective psychology of the period is the most dominant. Information necessary to the solution of the problem was: (1) background data relative to the inception and subsequent development of camping in education, (2) data concerning the socio-cultural scene during the period 1930--1960, and (3) descriptive data regarding the current status of school camping.

SUMMARY

The documentation of camping education's rise and development was organized chronologically. The interpretation and analysis of the socio-cultural influences pertinent to the problem were treated topically. The major characteristics of camping education's three developmental stages were described. These three stages were: The Period of Inception, The Period of Experimentation, and The Period of Standardization. Relationships between developments in school camping and the various socio-cultural influences were explored. Finally, inasmuch as historiography should stress the possibilities for applying the interpretation of data to current issues and problems, the ultimate role of school camping to education and to teacher education was discussed.

CONCLUSIONS

1. The emergence of school camping as an integral part of American public education was socio-cultural in origin. Philosophical, educational, social, political, and economic influences were instrumental in shaping the development of camping education.
2. The modern movement of camping education was the embodiment of an ideology whose origins can be traced to the doctrines of Rousseau, Pestalozzi, Herbart and Spencer.
3. The detrimental economic and social effects during and immediately following The Great Depression prompted a re-appraisal of the objectives of education. School camping was simply one form of curriculum experimentation.

4. The educational program of the Civilian Conservation Corps laid the groundwork for public school camping. The C.C.C. also provided physical facilities that were later used to initiate pilot camping education projects.

5. Camping education was an expression of the pragmatic or experimentalist influence on education. It was an outgrowth of the broadened objectives of education, and the expanded function of the American public school.

6. As the needs-structure of society change so must the functions of its institutions change. Social institutions also have the obligation to perpetuate the desirable features of the social order. School camping was the embodiment of education's task to preserve and promote the democratic ideology.

Microfilm \$2.85; Xerox \$9.90. 218 pages.

THE URBAN LEAGUE, A DYNAMIC INSTRUMENT IN SOCIAL CHANGE: A STUDY OF THE CHANGING ROLE OF THE NEW YORK URBAN LEAGUE, 1910-1960.

(Order No. Mic 61-2556)

Edward Shakespear Lewis, Ph.D.
New York University, 1961

The problem presented in this thesis is to examine the changing role and purposes of the New York City Urban League from 1910 to 1960, and to study the ways in which the League has attempted to implement these purposes. In brief, this study of a local Urban League is, in a limited sense, a life history document of an interracial community organization to test the broad hypothesis that an agency continues to be dynamic to the extent that it has the freedom to evaluate and continually alter its program.

Methodology

The historical method of research has been used throughout this study. Since the Urban League movement had its origin in New York City, it was important to examine the early background of the organization even a decade before the League came into existence. Accordingly, this study begins in 1900 with a description of problems affecting Negro residents of New York City.

Among the principal sources of data was the Schomburg Collection on Negro Literature of the New York Public Library. Furthermore, there were available Annual Reports, Board minutes and scores of studies made by the League on employment, health, housing and educational problems. Two major evaluation surveys by Dr. Florence Kennedy and Dr. Clara A. Kaiser, Columbia University Professors, were of paramount importance in providing clues to the hypothesis of this study.

Hypothesis

The basic hypothesis of this study that an agency continues to be dynamic to the extent it has the freedom to evaluate and continually alter its program seemed to have significance not only for the Urban League but for other community organizations in the intergroup relations field.

Findings

There is one significant finding of this study which stands out above all others; namely, that the role of the New York Urban League has undergone a profound change, especially during the past two decades. In the early decades, 1910-1940, the League was considered by most social work leaders as a service agency to help adjust Negroes to an urban environment. Discrimination in employment and education, and segregation in housing were its principal concerns. But new government-supported agencies such as the New York State Commission Against Discrimination, New York City Commission on Intergroup Relations, Board of Education's Commission on Integration, Sharkey-Brown-Isaacs Law, have taken over functions at one time exclusively in the province of the League. A major function of the League today is to persuade these agencies to do a job which the League cannot possibly do alone. Certainly, there are many institutions working with other minority groups such as Jews, Puerto Ricans and Catholics that have brought invaluable resources to organizations like the League.

It was pointed out in several decades that the League had the freedom to make important needed changes in its program but it did not take advantage of the opportunities for alteration that were available. Apparently, changes in program and direction only took place when there were overwhelming community pressures or special events such as wars, depressions or the Supreme Court Decision on Public School Segregation.

Finally, the relationship between motivation in program and feedback, which are tied in with community pressures, is pointed out in order to show how a local Urban League has operated to bring about some important social changes affecting Negroes in New York City in the fields of employment, housing and education.

It is hoped that this study of a local unit of the oldest interracial agency in the nation will be useful to students of intergroup relation problems, Urban League staff and volunteers and to community organization specialists.

Microfilm \$4.30; Xerox \$15.10. 335 pages.

EDUCATION, PHYSICAL

STATED FACTORS IN THE SELECTION OF PHYSICAL EDUCATION TEACHERS IN COLLEGES AND UNIVERSITIES OFFERING AN UNDERGRADUATE MAJOR IN PHYSICAL EDUCATION

(Order No. 61-2901)

Frederick Richard Drews, P.E.D.
Indiana University, 1961

Chairman: Karl W. Bookwalter

The purpose of this study was to determine and evaluate the factors which influence the selection and appointment of men physical education teachers in colleges and universities.

The procedures used were: (1) developing a checklist of qualities and procedures from the literature, (2) conducting a pilot study through personal interviews with selected authorities to refine and revise the checklist items, (3) employing the use of a jury selected on the basis of empirically determined criteria from the American Academy of Physical Education to rate each checklist quality and procedure according to its importance, and (4) having the checklist items rated in personal interview by a stratified random sample of 34 out of 102 eligible chairmen of departments of physical education in colleges and universities in the Midwest District of the American Association for Health, Physical Education, and Recreation.

The data were analyzed as follows: (1) The Peters' and Van Voorhis' infinity prediction coefficient of .94 was obtained on jury agreement regarding qualities of the physical educator, and a jury reliability of .86 was found regarding the procedures for locating, screening, and selecting college and university physical education teachers to be employed primarily for teaching in the undergraduate physical education major program; (2) The obtained means on all checklist items given by chairmen of departments of physical education were studied according to the effect of enrollments of institutions, types of institutions, and number of physical education major graduates; (3) Sub-sample means were compared with jury means on all items according to the rating scales used in the checklist; (4) Pearson product-moment and rank order correlations were determined to indicate agreement between the jury and chairmen of departments of physical education on the subject categories of Education and Training, Experience, Guidance, Personal Characteristics, Professionalization, and Teaching Ability; (5) Analysis of Variance was calculated on all items under each variable studied and "t" tests were run on all significant items.

Within the limitations of this investigation, the following conclusions were made: (1) The checklist of qualities and procedures is the result of combined opinions and knowledges of administrators, teachers, and researchers and is highly complete; (2) The personal interview technique using a checklist is an efficient and accurate survey method; (3) The jury of experts was in very high agreement on the importance of qualities of the college and university physical educator and in high agreement on the desirability of procedures used in locating, screening, and hiring new faculty members; (4) Greater importance is attached by

jurors and chairmen of departments of physical education to qualities concerning Personal Characteristics than to technical-professional qualities; (5) The qualifications recommended by the jury of experts for the prospective college and university physical educator demand high personal, professional, and technical qualities; (6) The personal interview is Frequently used by chairmen of departments of physical education to study qualities considered to be Indispensable or Extremely Important regarding candidates, and (7) Differences between ratings on items were non-significant on the majority of the items studied. General agreement by chairmen of departments of physical education on the importance of the majority of the qualities and procedures studied appears to exist.

Microfilm \$5.90; Xerox \$20.95. 461 pages.

A STUDY OF TENSIOMETER STRENGTH IN BOYS SIX TO ELEVEN YEARS OF AGE

(Order No. Mic 61-2777)

Chester Walter Murphy, Ed.D.
University of Michigan, 1961

The problem of this study was to measure the strength of a selected group of muscles in elementary school boys for the purpose of studying the pattern of muscular development in boys ages 6 to 11.

Seven muscle groups were tested in 657 subjects selected from nine elementary schools in Minneapolis-St. Paul, Minnesota. The instrument used was the aircraft cable tensiometer, and the muscle groups tested were the elbow flexors, elbow extensors, shoulder flexors, shoulder extensors, hip flexors, hip extensors, and knee extensors. Total strength, i.e., the sum of all these measures was also computed for each subject.

The data were coded and transferred to IBM punch cards for use in an IBM electric digital computer. By ages, there were 79 six year old boys, 136 seven year olds, 93 eight year olds, 116 nine year olds, 124 ten year olds, and 109 eleven year olds. For all statistical work strength indices (strength/body weight) were used.

The mean scores for the strength indices of the tensiometer test items and for the total of them were plotted graphically for each age and for four height levels. The mean scores of the tensiometer test items were expressed as percentages of the mean of the total strength index in order to indicate the percentage contribution of each muscle group to total strength.

Similar graphs were made for the five weakest boys and for the five strongest boys at each age level, i.e., the five boys at each age level having the lowest total strength indices and the five boys having the highest total strength indices.

The Pearson product-moment method of correlation was used to determine the inter-correlations between the strength indices, and to determine the correlations between each index and the total strength index. The correlations were checked for statistical significance by means of the Wallace-Snedecor tables. A probability of .05 was used as the level of significance for this study. First order partial correlations were used to determine the relationship between tensiometer strength and age uninfluenced

by height differences, and between tensiometer strength and height uninfluenced by age differences. The standard error of these partial coefficients were computed as a check on the reliability of the coefficients. For each of the tests administered, the following statistics were computed for each age and for each height level to provide comparable indications of central tendency and variability; mean, standard deviation, standard error of the mean, range and t values. The differences between the means at each age and at each height level were tested for statistical significance. Regression equations were computed for each index.

The conclusions are as follows: (1) the pattern of growth in strength is an irregular one for the six age brackets studied; (2) the pattern of growth in strength is irregular as height increases; (3) the percentage contribution made by each muscle group fluctuates slightly through the age levels, and through the height levels; (4) the pattern of growth in strength for the five weakest boys and for the five strongest boys does not vary greatly from the pattern of strength found in the total group of boys tested; (5) the percentage contribution made by the muscle groups of the five weakest boys and of the five strongest boys at each age level varies only slightly from that made by the muscle groups of the total group of boys tested.

Microfilm \$2.75; Xerox \$6.00. 125 pages.

THE CONSTRUCTION OF SCALES FOR PREDICTING ABILITY TO PLAY INTERSCHOLASTIC BASKETBALL

(Order No. 61-2909)

Paul Edward Pierce, Ed.D.
University of Houston, 1961

The purpose of this study was threefold: (1) to determine to what extent a high school basketball player's ability to play basketball was based on: (a) known criteria and (b) physical skills measurable by objective tests; (2) to determine the most useful known criteria and objective tests most practical and useful for measuring these physical skills, and (3) to develop a method for computing a boy's "Basketball Classification Index." The objective tests that made up the battery were selected which required a minimum of equipment.

To help in the selection of the objective physical skill tests, the personal factors, and to establish procedures and techniques a pilot study was conducted at Sam Houston State Teachers College. Twenty basketball tests were considered in this study, ten were selected and ten were discarded because they were not entirely objective or were too difficult to administer. The tests selected were; jump and reach, basketball shoot, obstacle dribble, shuffle step, dribble and shoot, wall bounce, free throws, thirty-five foot shoot, two hundred foot forward run, and one hundred foot backward run. Eight personal factors were considered and three were discarded because it was believed that they were not vital in determining a boy's basketball ability. The personal factors selected were; height, age, weight, grade level, and experience in basketball.

In the main study the coaches of all the participating schools administered the ten objective tests and obtained the personal data information on all their basketball players

and boys in physical education classes. The data on the five personal factors and the scores on the ten objective tests were tabulated for the 506 boys from the eleven participating schools. On the basis of a careful analysis of the range of raw scores made by the 506 boys on each of the fifteen factors, raw scores in each distribution were arbitrarily assigned rank values from one to ten. The sum of the ranks earned by each boy on the fifteen variables gave each boy's Basketball Classification Index (BCI). The BCI's on the 506 boys then had a possible range from fifteen to one hundred fifty.

From the BCI's the predictions were made. The boy having the lowest scores were considered first team for each of the three positions; center, guards, and forwards. The validating criteria was the coaches' selection of his first and second teams. It was found that the players selected on the first team, on the basis of the Basketball Classification Index, were the same as those selected by the coach in 85.6 per cent of the cases. The players selected on the first or second team on the basis of the Basketball Classification Index were the same as those selected by the coach in 97.1 per cent of the cases.

On the basis of this study five known or personal factors and ten objective basketball tests were found to be practical and useful for measuring the physical skills necessary to play interscholastic basketball.

Microfilm \$2.75; Xerox \$7.40. 156 pages.

EDUCATION, PSYCHOLOGY

THE EFFECT OF GROUP ORIENTATION ON THE OUTCOMES OF VOCATIONAL COUNSELING

(Order No. Mic 61-2231)

Helen Gene Duncan, Ed.D.
The University of Florida, 1961

The purpose of this study was to test the following hypotheses:

1. Group orientation to counseling can be used within the framework of a counseling center.
2. Counselor time can be used to reach more students when individual counseling is preceded by group orientation.
3. Individual counseling preceded by group orientation will be more effective in achieving specified goals than will individual counseling alone.
4. The use of group orientation will decrease the attrition rate.

During the spring semester of 1960, fifty male freshman and sophomore students who came voluntarily to the Counseling Center requesting vocational counseling were randomly assigned to experimental and control groups. Nineteen of the twenty-five in each group completed a pre-counseling inventory and made up the sample in the actual study. The control group received individual counseling only, while the experimental group participated in

two group orientation sessions prior to their individual counseling. No other major change was made in the usual procedure of the Center.

The purpose of the group orientation sessions was to develop a readiness for individual counseling. Topics discussed included aims and procedures of the Counseling Center, roles of client and counselor, general meaning and use of tests, the problem-solving nature of vocational counseling, and the role of personal and occupational information in vocational counseling. To insure control in the application of the experimental variable, participants were given a list of discussion topics, and all group sessions were led by the counselor conducting the study.

Where appropriate, the t-test was used to investigate the significance of the difference between the means of scores obtained from certain evaluative instruments administered to both groups before and after counseling. Data were analyzed for nineteen experimental and fourteen control group clients who completed both instruments. Both groups showed a significant increase in judged reality of vocational goals expressed after counseling. Differences between means on measures of self-knowledge, confidence, and occupational information before and after counseling were not significant. Both groups, however, tended to have more self-knowledge, less confidence, and reported less occupational information after counseling. Clients in the experimental group received an average of 4.9 hours with a counselor, while those in the control group received an average of 3.3 counseling hours. The total number of counselor hours for each group was 62.

From the findings of this study the following conclusions concerning group orientation to vocational counseling in a university counseling center similar to that in which this study took place seemed justified:

1. Group orientation to counseling can be used within the framework of a counseling center.
2. Group orientation to counseling enables a counselor to reach more students without reducing significantly the time students spend with a counselor.
3. Individual counseling preceded by group orientation is no more effective than individual counseling used alone in achieving the following goals:
 - A. Reduction of post-counseling discrepancy scores between test-ratings and self-ratings,
 - B. Increased confidence after counseling in self-ratings about personality, ability, and interests,
 - C. Expression of more realistic vocational goals after counseling,
 - D. Possession of more factual information about vocational goals after counseling.
4. Group orientation preceding individual counseling does not decrease the attrition rate.

Microfilm \$2.75; Xerox \$9.25. 205 pages.

**A COMPARATIVE STUDY OF CERTAIN
MOTOR SKILLS OF DEAF AND HEARING
MENTALLY RETARDED CHILDREN**

(Order No. 61-2911)

Ralph Lynn Hoag, Ed.D.
University of Arizona, 1961

Supervisor: Dr. David Wayne Smith

This study was a comparison of certain performance abilities in a selected group of deaf and hearing mentally retarded children. It was designed to compare sub-groups of etiological types within the basic deaf and hearing groups. The study required the selection of mentally retarded deaf and hearing children.

Male subjects attending three state residential schools for the deaf in the southwestern part of the United States were used to supply the deaf experimental subjects. The hearing mentally retarded boys, screened for possible inclusion in the study, were secured from the special education department of the Tucson (Arizona) public schools. These children served as the control group for the study. The experimental group of deaf mentally retarded children was made up of all available boys in the geographical area. They ranged in age between ten and fifteen years, and obtained I.Q. scores between sixty-five (65) and eighty-five (85) as determined by their performance on the Chicago Non-Verbal Examination. A total of twenty-two deaf children and twenty-seven hearing children participated in the research.

The Chicago Non-Verbal Examination was used to measure general mental ability of both groups of mentally retarded children. A total of 166 tests were administered to small groups of prospective subjects. This screening process together with considerations of age of onset of hearing loss, extent of hearing loss, and the absence of other physical handicaps, reduced the original total number of available subjects to forty-nine.

The various deaf and hearing children were classified into two sub-groups depending on the etiology of mental retardation. This classification process followed closely the technique developed by French, Cassel, Arbitman, Weissenberg, and Irwin. Eight of the twenty-two deaf children eventually used were classified etiologically as non-familial; the remaining fourteen were classified as familial. The twenty-seven hearing mentally retarded children used as a control group were divided into similar etiological sub-groups. Eight were classified as non-familial and nineteen as familial.

The placement of subjects in the four groups was such that all groups were statistically matched in age and intelligence. This arrangement made possible group comparisons in performance ability through the use of several different combinations. Group comparisons made in the study were as follows:

Total Groups - familial and non-familial
Deaf Groups - familial and non-familial
Hearing Groups - familial and non-familial

Total Groups - deaf and hearing
Familial Type - deaf and hearing
Non-familial Type - deaf and hearing

Mean scores of all the above groups were compared statistically in both age and intelligence. A test of significance

was made of the differences between variances and between means employing F-test and t-test techniques for purposes of matching groups.

The motor skill performance tests administered to all subjects in the above groups were as follows:

Visuo-motor - Werner-Strauss Marble Board Test
Tactual-motor - Werner-Strauss Tactual Motor Test
Spatial Relationships - Grace Arthur Stencil Design Test
Manual Dexterity - Purdue Pegboard Test
Locomotor Coordination - Heath Rail-Walking Test

The decision to use the above tests was based on previous success with deaf children. This was also true with respect to mentally retarded hearing children.

The specific nature of the selection criteria, together with the classification system employed, placed limitations on the number of actual subjects available for use in the research. The value of the findings has been limited by the small (N). In order to possibly add to the validity of the results of the investigation, comparisons were made with known findings from previous research involving similar groups of familial and non-familial mentally retarded children. It was hypothesized that if the performances of individual groups of deaf and hearing subjects used in this study were consistent with what had already been found, a further study of the performance differences of these two groups when compared directly might be of value.

Comparisons were made of the results of the various tests between the total familial and non-familial groups including both deaf and hearing subjects. This comparison suggested that the groups of children used in the research performed according to what had previously been suggested as being true of these two groups.

Conclusions

The results of this study, as previously stated, were limited by the small (N). The findings, however, were strengthened by the facts that: (1) the sample of deaf subjects included all available boys in the geographical area, (2) the sample of hearing subjects included all available boys in the special education department of Tucson (Arizona) public schools, (3) the groups as matched performed according to expectations, and (4) the performances of the deaf and hearing children used in this study compared favorably to the results that had been obtained in previous similar research.

The following conclusions were therefore made:

1. The motor tests used in this study were found to be of value for measuring the motor performances of both deaf and hearing individuals. Although the Marble Board Test was difficult to score, it did prove to be a more effective measuring instrument than the Tactual-Motor Test.
2. The mentally retarded deaf subjects were found to have made more coherent responses than the hearing group in their approach to the construction patterns on the Marble Board Test. Mean group performance differences between total groups of deaf and hearing subjects were found to be significant.
3. A comparison of the results between all groups of deaf and hearing subjects in the areas of spatial relationships, manual dexterity, and finger tip dexterity produced no significant differences between group performances.

4. The hearing subjects used in the study were significantly superior to the deaf in performance on the Heath Rail-Walking Test. This was true in a comparison of total groups of deaf and hearing subjects, and in a comparison of familial type mentally retarded groups of deaf and hearing subjects. The differences between non-familial groups of deaf and hearing on the Heath Test were not significant. This implies the possible conclusion that both deaf and hearing individuals, whose mental retardation is due to some form of brain injury, experience somewhat similar locomotor balance difficulties.

5. The lack of significant difference between the performances of non-familial mentally retarded deaf and hearing children on all the tests used, could indicate that these two groups were more similar in their performance abilities than were familial groups of deaf and hearing children. A larger (N) would be required in order to be able to make a more positive statement in this regard.

6. In general, the differences found between deaf and hearing mentally retarded children did not seem to have been greater or less than what had been found to be true of differences between more mentally normal groups of deaf and hearing children.

7. On the basis of the results of tests used in this research, it was necessary to reject the hypothesis that the additional handicap of deafness when coupled with mental retardation imposes a greater handicap on the individual in the performance of certain motor skills.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

**A STUDY OF CHANGES IN SELF-CONCEPTS
OF TEACHERS FOLLOWING PARTICIPATION
IN A CONSULTING MENTAL
HEALTH PROGRAM**

(Order No. Mic 61-2767)

James Clayton Lafferty, Ph.D.
University of Michigan, 1961

Recognition of teacher self-attitudes as important determinants of classroom management has been well established in the research literature dealing with learning, growth of self, pupil behavior and general classroom mental health. Measurement of changes in teacher self-concept, of reduction in actual-ideal self-discrepancies, and of the teacher perception of a mental health consultant on the Interpersonal Adjective Checklist were used to evaluate the effects of five mental health consultants on a sample of 121 teachers and administrators over the period of one academic year. The results from a control and an experimental group were compared in a before and after design.

Following participation in a voluntary mental health program teachers showed significant reductions in the frequency of maladaptive forms of interpersonal self-concepts. Participating teachers showed significant positive changes in actual-self concept on eight of the sixteen interpersonal scales of the Interpersonal Adjective Checklist. For participants there was also a reduction in compensatory ideal-self concepts that tended to be strongly managerial, controlling aspirations. Seven of the sixteen scales evaluating showed significant positive change. The

study indicated that the control group did not exhibit comparable positive change.

In summary, they felt significantly more self-respective, independent, self confident, and less doubtful about their own ability. They tended to be less easily embarrassed, less apologetic and less self-effacing. Thus reduction in the discrepancy between actual-ideal self-descriptions on a continuum from friendliness to hostility was associated significantly with participation in the program. There was no such significance attached to the reduction of discrepancy scores on the interpersonal continuum of autocratic to self-effacing responses.

Reduction of discrepancy scores was related to the degree of expressed satisfaction with the program. It was shown that participation in this type of mental health consultation program produced significant positive changes in the self-concept and reduced discrepancies between actual and ideal self-perceptions.

The participating teachers generally increased (p .001) in measures of self-confidence and friendliness. The non-participating teachers declined significantly (p .001) in measures of self-confidence and friendliness during the same period of time.

The teachers perception of self as being psychologically similar to the teachers perception of the consultant was an important factor with respect to continuation in the project after initially volunteering to participate in the mental health consultation program. The participants tended to describe themselves as being significantly more similar to the consultant than did the non-participants.

Microfilm \$3.20; Xerox \$11.05. 245 pages.

**THE ACQUISITION AND RETENTION OF
PAIRED ASSOCIATES BY GOOD,
AVERAGE, AND POOR READERS.**

(Order No. 61-2972)

Wayne Raymond Otto, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Theodore L. Harris

Purpose

The primary purpose of this study of paired associates learning and success in reading is to provide for (1) the control of pertinent methodological variables and (2) a study of possible interactions among selected variables of sensory reinforcement, grade placement, and reading level. Previous studies have lacked control of methodological variables and/or provision for a study of interactions.

The study is an experimental investigation of relationships that, once demonstrated, can serve as bases for further research in learning-to-read situations.

Method

A 3x3x3 factorial design was employed: three levels of reading proficiency; three levels of grade placement/chronological age--grades 2, 4, and 6; and three modes of reinforcement--auditory, visual-auditory, and kinesthetic-visual-auditory. Four Ss, two boys and two girls,

served under each of the 27 experimental conditions, making a total of 108 Ss. Group test IQ scores were held within the 95 to 110 range. The task was to learn and to recall/relearn after 24 hours a list of five paired associates.

Four measures of performance were obtained. (1) Associations evoked by the figures and trigrams. (2) Total acquisition trials required to master the list. (3) Quality of performance when the forms were presented in series. (4) Total trials required to relearn the list after acquisition trials.

Results

The analysis of acquisition scores is summarized in Table 1. Each of the three main effects is significant, but

TABLE 1
ANALYSIS OF VARIANCE OF THE ACQUISITION TRIALS

Source	df	MS	F
Grade (G)	2	498.94	79.91*
Reading Level (L)	2	406.735	65.14*
Reinforcement (R)	2	39.065	6.25*
GxL	4	34.347	5.50*
GxR	4	30.975	4.96*
LxR	4	5.16	
GxLxR	8	11.562	1.85
Within	81	6.244	

*P<.01

interpretation is complicated by the significant interactions. A similar analysis of relearning scores showed grade placement alone to be significant.

Results of the association test indicate that the demonstrated differences cannot be explained simply in terms of the number of associations attached to the stimuli of the paired associates list, since poor readers made more associations than good readers. There were no between group differences in ability to handle forms presented in series.

Conclusions

Good, average, and poor readers--in that order--require increasingly more trials to master a list of paired associates. This suggests that auto-instructional devices may have value in developing word mastery among average and poor readers. The reading level x grade interaction, however, indicates that further investigations must consider both reading level and grade level as pertinent and potent variables.

The mode of reinforcement x grade level interaction suggests that studies purporting to investigate the relative efficiency of different modes of reinforcement must recognize grade placement of the subjects as an effective variable.

There is not a significant interaction between mode of reinforcement and reading level. This is contrary to the common assumption in instructional practice that additional cues will be of value in a remedial teaching/learning situation.

Analysis of total relearning scores showed grade level

to be the only significant variable. Thus, it appears that once they have mastered a list of paired associates, poor readers will retain the associations as well as good readers.

There is no tendency for poor readers to be overwhelmed by two to five stimuli presented in series.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

AN ANALYSIS OF CULTURAL DIFFERENCES ON CERTAIN PROJECTIVE TECHNIQUES

(Order No. 61-2905)

Mauderie Hancock Saunders, Ph.D.
The University of Oklahoma, 1961

Major Professor: Percy T. Teska

There is ample evidence to show that 300 years of socio-economic and educational deprivation have had marked effects on the Negro in America. Most educational, intelligence and projective tests, although standardized on a white population, are used in the testing of Negroes. This experiment attempted to determine the applicability of the House-Tree-Person and Draw-A-Person tests to samples of first-grade Negro subjects to discover if these devices gave valid indices of certain intellectual, academic and adjustmental aspects. The experiment further attempted to study the interpretations of clinicians who used a common standard of appraisal.

The subjects of the experiment were Negro first-grade children of the Oklahoma City Public Schools whose responses were compared with white children of equivalent socio-economic backgrounds. The groups tested were divided into high-low categories for the qualities of intelligence, reading achievement, and emotional adjustment.

The chi-square test was used to evaluate high-low grouping against the judgment of three trained clinicians. A test of significance was employed to evaluate the accuracy of the judges in making analyses which were tested against substantiated case data.

Hypotheses were tested statistically to examine the probability that the judges were exceeding chance in their accuracy and that judgments were not influenced by the racial backgrounds of the subjects. Three groups of hypotheses were statistically tested:

1. Validity of judges' responses.
2. Agreement among judges in their responses.
3. Comparison of judges' responses on Negro and white children's projective productions.

Summary of Findings:

1. Judges made correct responses which significantly exceeded chance in determining mental ability, reading achievement, and emotional adjustment. Their responses did not exceed chance in determining the race of the children whose drawings they judged.
2. Judges agreed significantly in their responses to determine the four variables tested.
3. Judges did not differ in the correct number of

estimates made on Negro children when compared with the correct number of estimates made on white children.

Major Conclusions:

It seems valid to conclude that mental ability, reading achievement, and emotional adjustment are accurately evaluated by the House-Tree-Person and Draw-A-Person techniques. Selection by race was the method employed to determine whether or not Negro children conveyed their cultural and social limitations through drawings. Trained judges were able to appraise correctly the Negro and white children for their intellectual, academic, and emotional qualities but failed to discriminate between the experimental Negro sample and the white control group when they attempted to seek clues to ethnic origin. Judges were equally accurate on Negro and white subjects.

A major recommendation was that more extensive testing be done in order to further appraise the merit of these devices to augment the counseling process at the lower grade levels.

Microfilm \$2.75; Xerox \$8.00. 173 pages.

**A COMPARISON OF THE EFFECTIVENESS
OF GROUP-COUNSELING,
INDIVIDUAL-COUNSELING, AND
EMPLOYMENT AMONG ADOLESCENT BOYS
WITH ADJUSTMENT PROBLEMS.**

(Order No. Mic 61-2800)

Merrel Richard Stockey, Ph.D.
University of Michigan, 1961

The purpose of this study was to evaluate the effectiveness of counseling and employment in reducing aggressive behavior among adolescent boys who were experiencing difficulties in adjusting to school. Five hypotheses are listed. The first asserts that group-counseling, aimed at reconciling the demands of school life with the values of maladjusted, hostile, adolescent boys, results in decreased aggressive behavior. The second hypothesis states that individual counseling with such boys results in decreased aggressive behavior. The third hypothesis maintains that group-counseling is more effective than individual-counseling. The fourth hypothesis states that employment is a therapeutic device that will enable boys with jobs to show greater reductions in aggressive behavior than will be true for unemployed youths. The fifth hypothesis is that individuals who manifest maladjustment will, without special treatment, continue to exhibit the same behavior.

In September, 1958, all boys entering the Continuation Division of the Milwaukee Vocational and Adult Schools were given the following tests: Cooks HO Scale, Taylor's Manifest Anxiety Scale, the California Short Form Test of Mental Maturity (Intermediate), the California Reading Test (Elementary), the K-D Delinquency Proneness Test, and the Mooney Problem Check List (High School). A cut-off raw score of 25 on the hostility scale was used to select the sample. Random assignment was made to three groups: control, group-counseling, and individual-counseling. From the employed youths, those scoring highest on the hostility scale were selected for a fourth group. There

were fifteen boys in the control group, sixteen each in the individually counseled and employed groups, and fourteen in the group-counseled group.

Criteria for possible changes in adjustment were selected to reflect attitudes toward self, teacher evaluations, and academic achievement. In addition, records were kept of unexcused absences during the first quarter of the school year.

Boys selected for group-counseling were divided into two groups. Each group met twice a week for double class periods throughout the ten weeks of the first quarter of the school year. Individually counseled boys were seen for an hour each week for ten weeks. Members of the control group and the employed group were given no special treatment.

Test of significance were made for changes in score between first and second tests. A rather consistent pattern of improved adjustment was established for the group- and individually counseled youngsters. The control group, with one exception, demonstrated no significant change in test results. Employed youths similarly showed little change.

The results of this study do not show a superiority of group-counseling over individual-counseling. It is indicated, however, that the group method offers an excellent opportunity to extend service to more youngsters since it is approximately as effective as individual-counseling.

Employment is not therapeutic for the boys studied in this sample. Initially, working youngsters were significantly more anxious than control group members, and they maintained a comparatively high anxiety level throughout the experimental period.

A general conclusion is that counseling has demonstrated value in modifying the behavior of malfunctioning adolescents. Pursuit of this goal might prove of more enduring value than persisting in trying to force compliance with school regulations and academic standards.

Microfilm \$2.75; Xerox \$5.00. 97 pages.

EDUCATION, RELIGION

**RELATIONSHIPS AMONG ACCEPTANCE OF
SELF, ACCEPTANCE OF OTHERS, AND
BELIEF IN AN ACCEPTING GOD.**

(Order No. Mic 61-1074)

Charles Homer Ellzey, Ph.D.
Columbia University, 1961

A survey of past and present literature in the fields of psychology, religion, and education revealed a steadily growing trend toward viewing personality in its totality. Within this context, and in order to provide further understanding of persons for the purposes of education, psychotherapy, and church work the investigator undertook to examine the relations among attitudes toward self, others, and the concept of God's attitude toward oneself.

The hypothesis for the study was that a positive relationship exists among three major variables, *viz.*, expressed Self-Acceptance, expressed Acceptance-of-Others, and expressed Belief-in-an-Accepting-God.

In order to test this hypothesis three scales, measuring Self-Acceptance, Acceptance-of-Others, and Belief-in-an-Accepting-God, were devised and combined into a questionnaire of sixty-eight items. Five items were added measuring belief and nonbelief in God, and making a total of seventy-three items.

In making the scales, operational definitions of Self-Acceptance and Acceptance-of-Others were developed by revising the definitions used in a study by Berger.¹ An operational definition of Belief-in-an-Accepting-God was developed by the investigator.

The questionnaire was given to over 1,000 subjects in and around New York City and in two college marriage classes in Missouri. Five hundred and twenty-one valid answer sheets were returned, 328 indicating a belief in a personal God. Statistical data were obtained regarding various characteristics of the sample, and correlations of major and minor variables were made.

It was found that the three major variables were positively interrelated to a significant degree, providing support for the hypothesis. The correlations were as follows: Self-Acceptance--Acceptance-of-Others, .538; Self-Acceptance--Belief-in-an-Accepting-God, .302; Acceptance-of-Others--Belief-in-an-Accepting God, .322.

Correlations among several minor variables were obtained with results as follows:

1. Religious activity was found to have little relationship with Self-Acceptance and Acceptance-of-Others.
2. Religious activity and Belief-in-an-Accepting God were positively correlated.
3. The age of the respondents varied positively with the degree of religious activity.
4. No relationship appeared between age and Self-Acceptance.
5. Age was found to have little or no relationship with Acceptance-of-Others and Belief-in-an-Accepting-God.
6. Relatively little difference was found in the average scores of the total sample and a small number who were forced to take the test.
7. No significant difference appeared between men and women in relation to Self-Acceptance.
8. The relationship between sex and the degree of religious activity was found to be negligible.

The interpretation of the correlations among Self-Acceptance, Acceptance-of-Others, and Belief-in-an-Accepting God was made primarily in terms of common causal factors. With the support of much present-day literature in the fields of education, psychology, and psychiatry the investigator proposed that the development of attitudes of acceptance toward self and others and a belief in an accepting God occurs most likely in an atmosphere in which the persons themselves can receive acceptance and love. Ramifications of this thesis for the various areas of interpersonal relations; e.g., in education, applied social psychology, and institutional religion, were explored. Suggestions were made regarding methods of proving for the experience of being accepted while developing Acceptance-of-Self and Others, and Belief-in-an-Accepting-God.

Fifteen suggestions for further research were presented, based on various findings in the study. Finally, a critical analysis of the study was made by the investigator.

1. E. M. Berger. "Relation between expressed acceptance of self and expressed acceptance of others," Unpublished doctoral dissertation, University of Pittsburgh, 1950.

Microfilm \$3.25; Xerox \$11.25. 249 pages.

EDUCATION, TEACHER TRAINING

A STUDY OF COMMUNITY SERVICES AS PROFESSIONAL LABORATORY EXPERIENCES IN THE PRESERVICE PREPARATION OF TEACHERS IN MUSIC AT KNOXVILLE COLLEGE, TENNESSEE.

(Order No. Mic 61-2572)

Rosemary Frayser Adams, Ed.D.
New York University, 1961

Chairman: Professor William P. Sears

Purpose of the Study

The purpose of this study was to develop a program of professional laboratory experiences in music designed to meet academic standards for the preservice preparation of teachers at Knoxville College and at the same time provide services for community organizations in Knoxville.

Methods Used

Two methods were used to secure data for the study. The historical method involved a review of books, research studies, articles, bulletins, and reports. The published standards of the American Association of Colleges for Teacher Education and Music Educators National Conference were used as sources from which criteria for the evaluation of the present Knoxville College program were evolved.

Normative-survey techniques were employed and questionnaires were sent to three selected groups: (1) church-related, liberal arts member colleges of the Southern Association of Colleges and Secondary Schools; (2) member churches of the Knoxville Interdenominational Ministerial Alliance and the Knoxville Ministerial Association; and, (3) agencies affiliated with the Council of Community Services, Incorporated, in Knoxville.

The questionnaire sent to colleges was designed to ascertain the structure and content of teacher preparation programs in music, the nature and extent of musical services provided for the college communities, and the opinions of music department chairmen as to the use of certain designated activities as professional laboratory experiences. Questionnaires sent to churches and community agencies were constructed to explore the musical activities and needs which could serve as professional

laboratory experiences for prospective teachers at Knoxville College.

Findings and Interpretations

From the questionnaire survey and catalogue study of colleges, findings, interpretations and conclusions were developed as follows:

1. Fifty-one of the sixty colleges from which catalogues were received prepare teachers in music.
2. Questionnaire responses indicated that 58 per cent of the music majors in twenty-nine colleges were enrolled in degree programs for the preparation of teachers.
3. The programs of the colleges studied offer preparation commensurate with the recommendations of Music Educators National Conference, including direct experience through various forms of musical participation.
4. Professional laboratory experiences are concentrated primarily in student teaching in the public schools.

On the basis of these findings, it was observed that: (1) the study of music entails both theoretical study and participation in the development of skills; (2) such participation may or may not involve direct contact with children, youth, and adults; (3) it is, therefore, necessary to differentiate and relate laboratory experiences and those experiences which represent the application of skills in the performance of professional functions.

The survey of community organizations revealed that:

1. Opportunities for professional laboratory experience are available in thirty-one churches and community agencies in Knoxville.
2. The musical needs of these organizations offer a variety of experiences with children, youth, and adults.

Recommendations for Knoxville College were made in the form of a proposed program based on the findings previously discussed and on the needs of the college as revealed from an evaluation of the present offerings in music. Microfilm \$4.20; Xerox \$14.85. 326 pages.

CERTAIN FACTORS THAT CONTRIBUTE TO NON-CONVICTION OF RESPONSIBLE DRIVERS IN MOTOR VEHICLE ACCIDENTS RESULTING IN A FATALITY

(Order No. Mic 61-2681)

James Edwin Carnahan, Ph.D.
Michigan State University, 1961

Major Professor: William A. Mann

The Problem:

Violators are not being convicted to the extent one would expect for traffic violations that results in fatal

accidents. This may be due to certain factors such as: 1) insufficient evidence as a result of poor accident investigation; 2) the use of officers poorly trained in accident investigation; 3) evidence available to officer too limited to warrant criminal action as a result of no witness to the accident; 4) sympathetic jurors who are not educated to the magnitude and the seriousness of the problem; 5) failure of the prosecutor to initiate action where there is apparently sufficient proof of negligence; 6) possible indifference of some judges and prosecutors to the traffic problem; 7) cases where convictions are obtained, the sentence is often negligible; 8) and possibly others.

Procedure:

Records of the accidents that resulted in fatalities in the State of Michigan for the years 1957 and 1958 were obtained from the files of the Michigan State Police. These records were studied and those that did not show the complete disposition of the case and showed evidence of a traffic violation were sent to the prosecutor of the respective county to determine both the disposition of the case and the reasons for his action. The data from both the accident reports and the questionnaires returned by the prosecutors were tabulated onto 5" by 8" index cards for final analysis.

As a cross check on the case disposition from the central files of the State Police and the returns of the various prosecutors, numerous cases were sent to the Driver Improvement Services of the Department of State to establish if there was any action taken against the violator for which the other files showed no record. A further check was made on the State Police files by sending the complete list of fatal accidents happening in a respective county to several prosecutors in order to determine if the two files were in agreement. In addition numerous cases were drawn from the Wayne County files in order to determine if all cases were recorded in the central files of the State Police.

Thirty-five enforcement agencies were contacted and one hundred and two officers interviewed concerning their opinion as to convictions in motor vehicle violations resulting in a fatality. This information was compiled into tables along with that from the index cards in preparation for the final report.

Summary and Conclusions:

Summary. A study was made of 1940, 73 per cent, of the 2532 fatal accidents that occurred in the State of Michigan during 1957 and 1958. There were 1730 drivers who survived, 753 of whom appeared to be in violation. Charges were filed against 274, 36 per cent, of the drivers appearing to be in violation. There were 206 cases bound over to circuit court with 148, 71 per cent, found guilty and 58, 29 per cent, acquitted. There were 21 cases dismissed in the preliminary hearing. Of the total 227 cases filed for circuit court action, 65 per cent were found guilty and 35 per cent not guilty. The total drivers convicted in the circuit and lower courts for the 274 charges filed were 190, 69 per cent.

The prosecuting attorneys stated 509 reasons for non-prosecutions against the 456 drivers who appeared to be in violation. Some reasons given were: insufficient evidence, 35 per cent; other people contributed, 21 per cent;

victim related to driver, 18 per cent; road and weather conditions, 3 per cent; defendant has suffered enough, 3 per cent; and numerous other statements, 20 per cent.

Officers of the thirty-five enforcement agencies contacted report their problems to be: public apathy and sympathy for the defendant; lack of sufficient budget and personnel; need for departmental expansion; difficulty in locating and obtaining witness; difficulty in obtaining other forms of evidence; improper follow-up on accident investigation; cases lie too long on the docket; prosecutor feels that defendant has suffered enough; prosecutor does not have time and does not wish to be bothered with traffic cases; prosecutor not paid enough and has to combine civil and criminal activities in same office; prosecutor wants a good conviction record, reduces charges to obtain a plea of guilty; prosecutor fails to prepare cases in advance; jurors identify with the violators; jurors are too sympathetic, allow emotion to over-rule reason; lower courts go beyond their function in preliminary hearings; circuit courts will not allow expert testimony; judges impose light sentences; usually probation; need for better legislation.

Conclusions. The prosecutor is unable to initiate action in approximately 20 per cent of the cases against a driver who has committed a traffic violation that results in a fatality. He fails to initiate action in an additional 20 per cent of the cases and files on the remaining 60 per cent. Eighty-five per cent of the cases filed are bound over to circuit court and 15 per cent are tried in the lower courts. Eleven per cent of the cases bound over to circuit court are dismissed on motions from the prosecutors for nolle prosequi. There appeared to be sufficient evidence for the initial charge but the prosecutor changed his mind. Does this suggest that reasons other than evidence per se are getting cases thrown out of court?

Sixty per cent of the cases tried in lower court were for reckless driving or driving while under the influence. The question arises as to why these cases were not tried in circuit court? Neither gross negligence nor intent must be proved in a charge of negligent homicide while reckless driving constitutes a wilful and wanton disregard for persons or property.

The reasons most frequently stated by prosecutors for non-prosecution was that victim was related to driver and/or the violator had suffered enough, 20 per cent of total statements. Would the action be the same for crimes committed other than by motor vehicle? The prosecutor is perhaps anticipating public reaction and jury response? Does the public want enforcement for motor vehicle violations and if so to what degree?

Approximately 30 per cent of the cases tried in circuit court resulted in acquittals, most of which were for negligent homicide. The jurors identify with the violators and are reluctant to convict him for a violation they themselves might commit. The courts that find the violator guilty often impose light sentences. Over one-half the sentences were fines, probation, and/or restricted driving. Ten per cent of the sentences were only restricted driving. Perhaps the courts at this point are duplicating that which would be done by the Secretary of State?

Microfilm \$2.75; Xerox \$6.40. 135 pages.

A STUDY OF THE MATHEMATICAL UNDERSTANDINGS POSSESSED BY UNDERGRADUATE STUDENTS MAJORING IN ELEMENTARY EDUCATION

(Order No. Mic 61-2326)

Emma C. Carroll, Ed.D.
Wayne State University, 1961

Adviser: Charlotte Junge

Purposes:

Major purposes of the study were to determine the mathematical understandings which the teacher of elementary arithmetic should know, to develop a valid and a reliable test instrument to measure possession of these, to make a diagnostic survey of the understandings of a group of preparatory teachers and to make a precise study of the relationship of pertinent academic and other background factors.

Study Procedures:

1. A list of mathematical understandings was structured from a tabulation of understandings taught in five leading textbook series and was validated as a list of understandings which the elementary teacher should know, by thirteen mathematics education authorities.

2. A two form, multiple choice type objective test was designed to correspond to the list of understandings and to measure each understanding separately.

3. The 178 item double-length test was administered to a cross section of 317 elementary education students at five educational levels at the Wayne State University. Diagnostic studies of the students' possession of the understandings were made with item analyses and other appropriate statistical techniques.

4. Relationships of mathematical understanding to academic and other background information about students were studied with correlation and analysis of variance techniques.

Conclusions:

1. Understandings necessary to learning in arithmetic may be determined from current teaching materials.

2. Content validity of the Mathematical Understandings Inventory developed as the test instrument for this investigation was established by tying the test items to the validated understandings list.

3. Construct validity was established for the Mathematical Understanding Inventory by a correlation of .65 with total scholastic aptitude, a correlation of .41 with honor point averages and by the analysis of variance* study which showed significant differences at the .01 confidence level in the means of understanding score groups when classified by scholastic aptitude, by high school mathematics grades, by honor point averages and by attitude.

4. Reliability was established for the Mathematical Understanding Inventory by a correlation of the two test form total scores which yielded a raw reliability coefficient of .80, by the Spearman-Brown prophecy formula which yielded a coefficient of .89 and by an analysis of variance procedure (Hoyt formula) which yielded a coefficient of .935.

5. Internal consistency of the Mathematical Understanding Inventory was established by contrasting the item responses of the upper 27 per cent of the testees with the lower 27 per cent of the testees with Flanagan's table of estimated correlation coefficients. Most items had validity coefficients of over .25.

6. The testees possessed a few more than half of the understandings agreed upon by the experts as the ones which elementary arithmetic teachers should know. The mean understanding (adjusted) score was 39.98 with a range of 13 to 63.

7. Students were weak in understanding fraction, decimal, per cent and mensuration processes.

8. There were small, specific understanding "gaps" in basic meaning concepts.

9. The findings of the study substantiate the findings of earlier studies in regard to the general picture of mathematical understanding possessed by elementary teachers in training and by in-service teachers.

10. There were significant relationships at the .01 confidence level between mathematical understanding and the following background variables:

- a. Scholastic aptitude as measured by total scores on the American Council on Education Psychological Examination.
- b. College scholarship measured by honor point averages.
- c. High school and college mathematics grades reported by students.
- d. Students' favorable self-appraisals of mathematical understandings.
- e. Study of an arithmetic methods course.

11. No significant relationships were found between mathematical understanding and the following background variables:

- a. Sex
- b. Number of years of high school mathematics studied.
- c. Number of college mathematics courses studied.
- d. Number of years of teaching experience.
- e. Experiencing by the testees of mathematics teaching which emphasized practical life applications.
- f. Experiencing by the testees of mathematics teaching which emphasized meaningful learning.

12. Mathematical understanding and age were negatively correlated, -.128.

Microfilm \$3.35; Xerox \$11.70. 260 pages.

AN ACCOUNT OF THE DEVELOPMENT AND APPLICATION OF A RESOURCE UNIT STRESSING THINKING FOR A COURSE: ETA 2. VALUES, THINKING AND PLANNING. (VOLUMES I AND II).

(VOLUME III: Some techniques and resources useful in promoting critical thinking. A Resource Unit prepared for use of instructors in the ETA 2 Program at the School of Education, New York University).

(Order No. Mic 61-2547)

Roger Cartwright, Ph.D.
New York University, 1961

Chairman: Professor Louis E. Raths

This study describes the preparation, application and evaluation of a resource unit designed to stress critical thinking. A trial of the unit was made in one section of an undergraduate education course. The purpose was to produce a design which helped instructors to construct many assignments that would confront students with the need to think deeply and to reflect on their thinking.

The resource unit has three key elements:

- (1) Eleven Thinking Operations: Observing, Summarizing, Comparing, Confronting One's Own Thinking, Analyzing Others' Thinking, Classifying, Formulating the Problem, Interpreting Raw Data, Identifying and Weighing Assumptions, Collecting Data, and Stating and Defending a Position.
- (2) Five basic aims: To help students to:
 - (a) Identify and clarify their own values, needs, attitudes, purposes, beliefs and ways of thinking.
 - (b) Increase awareness and understanding of the values, needs, attitudes, purposes and ways of thinking of their peers.
 - (c) Become conversant with important issues, principles, people and thinking in the field of education.
 - (d) Gain knowledge about the children they will teach.
 - (e) Relate personal and professional concerns to broader social-cultural surroundings.
- (3) Associated theories of thinking and valuing which relate changes in behavior to promotion of critical thinking and value clarification.

Ten major categories for resource materials were developed. The thinking operations and basic aims guided selection of appropriate materials and construction of assignments which were used in class sessions and in short individual conferences held weekly with each student. Students were repeatedly (1) confronted with the need to think in many ways and to identify and reflect upon such thinking; and (2) encouraged in attempts to clarify values. Efforts to use new insights in a self-directed modification of thinking habits and related behavior were strongly supported. A set of thinking-related patterns of expression and a number of value-clarifying questions were of key importance in this process.

In addition to protocols of student conferences and logs of class sessions, three evaluation instruments were used:

- (1) Interpretation of Data Test, Forms 2.51, 2.52: Class gains reached a 5 per cent level of significance in the subscore Beyond the Data. Scores were not significant in areas of General Accuracy, Caution, or Crude Error, however; a combining of probabilities for part scores (according to Lindquist) resulted in statistical significance in all four score areas.
- (2) Panel Judgments of Student Before-and-After Writings in three categories-- (a) Observing, (b) Formulating the Problem, and (c) Comparing. Data indicated substantial gains in (b), and, with qualifications, in (c), but no detectable trend in (a).
- (3) Before-and-After Student Self-Ratings on a Thinking-Related Behavior Scale: Substantial gains were made by the class in two of seven behavior categories: Confused and Impulsive. Results in Misses the Meaning were inconclusive. The remaining four categories were infrequently marked. Data on total gain supported the idea that the resource unit stressing critical thinking was a factor in contributing to student growth in rated behaviors.

It was hypothesized that five out of six especially chosen experimental students would demonstrate a gain of three or more points in one behavior category, and that if this condition was not met, the methodology was to have been regarded as having failed to effect change in terms of the theory relating certain characteristic behaviors to persistent thinking habits. The data supported the hypothesis: five of the six students made gains ranging from four to eight points. In total cases of gain, these six students stood well above an average for equated groups of six from four comparison classes.

The revised and expanded resource unit is offered as a contribution to curriculum theory and practice in the preparation of teachers.

Microfilm \$15.85; Xerox \$56.60. 1257 pages.

**BASIC CONTENT FOR THE STUDENT
TEACHING PHASE OF BUSINESS
TEACHER PREPARATION**

(Order No. 61-2907)

Geraldine Berniece Ebert, Ed.D.
The University of Oklahoma, 1961

Chairman: Professor Gerald A. Porter

The problem of this study was to determine what should be included in a program of student teaching for prospective teachers of business subjects so that adequate pre-service teaching experience may be provided.

More specifically, the solving of this problem involved two major tasks: (1) definition and verification of what constitutes competence in the teaching of business subjects at the secondary school level and (2) selection of content for student teaching that will be most conducive to developing such competence in beginning secondary school business teachers.

By means of a survey of related research studies, it was established that teachers are generally required to fulfill a variety of roles in completing the tasks commonly assigned to them. Each of the major roles involves numerous minor aspects with varying emphases in day-to-day teaching activities. In this study the many aspects of competence required in business teachers were defined, described in detail, and carefully authenticated. The aspects of competence were then related to the student teaching situation, and a statement of the appropriate content of student teaching for prospective business teachers was developed. The statement of content clearly points up the nature and scope of the understandings and abilities which student business teachers should develop and extend through student teaching activities.

Conclusions Reached:

1. There are six fundamental areas of educational endeavor in which teachers should be competent if they are to be rated as "master teachers." These fundamental areas include: curriculum, guidance, instruction, extra-class activities, liaison, and professionalism.
2. The nature and scope of the work of business teachers is such that numerous kinds of understandings and abilities must be acquired or extended through student teaching activities if prospective business teachers are to become adequately prepared for initial employment.
3. The outline of the content of student teaching for prospective business teachers developed in this research study can and should be utilized in the immediate future to fulfill its purpose of ensuring that adequate pre-service experiences are provided. It should be utilized by administrators of student teaching programs, college supervisors of student teaching, secondary school administrators, cooperating teachers, and student teachers so that its value may be maximized.

Microfilm \$2.75; Xerox \$7.20. 151 pages.

**THE IN-SERVICE EDUCATION NEEDS OF
THE BUSINESS EDUCATION SUPERVISING
TEACHERS IN THE INDIANA STATE
TEACHERS COLLEGE STUDENT
TEACHING PROGRAM**

(Order No. Mic 61-2832)

Robert Everett Hoskinson, Ph.D.
The Ohio State University, 1961

The purpose of the study was to determine (1) a set of guiding principles that should govern the work of the effective supervisor of student teachers, (2) the in-service education needs of the business education supervising teachers participating in the Indiana State Teachers College student teaching program, and (3) whether or not these needs justified an in-service education program for such teachers.

A search was made of professional literature to determine those guiding principles for the effective supervision of student teachers upon which there is common agreement

among authorities. A list of supervisory activities that had been used to implement these principles was also compiled from professional literature.

Check lists were submitted to the business education supervising teachers who had participated in the Indiana State Teachers College student teaching program. These teachers were asked to indicate the degree of help they needed to perform more effectively the 120 supervisory activities compiled in an earlier portion of the study. Check lists were also submitted to business education student teachers, former student teachers who had become full-time teachers, and college supervisors. These respondents were asked to indicate the effectiveness with which the supervising teachers in this study performed their supervisory activities.

Responses were assigned arbitrary weights and then ranked to determine the degree of effectiveness with which the 120 supervisory activities on the check list were performed.

Authorities were in agreement that the supervising teacher should (1) perform his responsibilities as an integral part of the teacher education program, (2) know as much as possible about the student teacher with whom he will be working, (3) orient the student teacher to all facets of the student teaching experience, (4) establish a team relationship with his student teacher, (5) gradually induct the student teacher into the activities of a full-time teacher, (6) plan cooperatively the experiences for his student teacher on the basis of the latter's abilities, needs, and interests, (7) provide the student teacher with as many as possible of the activities which a teacher is likely to perform on his job, (8) participate actively in a continuous evaluation process which enables the student teacher to develop skill in self-evaluation, (9) guide his student teacher toward greater professional and personal growth, and (10) help the student teacher prepare for his first teaching position.

Business education supervising teachers in the Indiana State Teachers College student teaching program were in need of further in-service education experiences.

The supervising teachers in this study indicated that short conferences at a college, college workshops, and local or regional workshops were the kinds of in-service experiences that would be most beneficial to them in the future.

Those general phases of the supervising teacher's work that needed much improvement were working as an integral part of the teacher education program, becoming acquainted with the student teacher, planning the student teacher's program, guiding the professional and personal growth activities of the student teacher, and helping the student teacher prepare for his first job.

Those general phases of the supervising teacher's work that needed some improvement were guiding the student teacher in his in-class teaching activities, guiding the student teacher in his out-of-class teaching activities, and evaluating student teacher progress.

Those general phases of the supervising teacher's work that needed little improvement were acquainting the student teacher with his new environment, developing an effective working relationship with the student teacher, and inducting the student teacher into full-time teaching.

Microfilm \$6.00; Xerox \$21.20. 470 pages.

AN ANALYSIS OF THREE PRE-STUDENT TEACHING EXPERIENCES IN THE PREPARATION OF ELEMENTARY SCHOOL TEACHERS

(Order No. Mic 61-2715)

William Ward Sinclair, Ph.D.
Michigan State University, 1961

Major Professor: William V. Hicks

This study is an attempt to determine which of three different pre-student teaching experiences best prepared the elementary student teacher for her full term of student teaching at Michigan State University.

During the Fall Term, 1959, a random selection was made of the applicants for Winter Term, 1960 elementary student teaching which placed thirty students in a reading group, thirty-two in an observation group, and sixty-seven in a control group.

Students in the reading group earned three term credits in the College of Education through independent reading in the field of education. Students in the observation group earned three term credits by observing three hours per week in an elementary classroom. Students in the control group were enrolled in normal classes in the College of Education.

The Minnesota Teacher Attitude Inventory and the Purdue Teachers Examination: How I Teach were administered to all of the students on three different occasions. The first occasion was a pre-test administered in September, 1959 to determine whether or not there was a significant difference among the three groups. The second was administered during the first week of student teaching in the Winter Term, 1960 to determine what changes, if any, occurred among the groups as a result of their different experiences during the previous term. The last testing session was held during the final week of student teaching to determine what influence, if any, student teaching had on the different groups.

Each student in the reading and observation groups was interviewed twice during the Fall Term, 1959. Each student in these two groups also submitted an evaluation of her experiences as a member of one of the groups.

The interviews, evaluations, and test results comprise the data used in this study.

An analysis of variance was computed for each administration of the tests to determine what differences existed among the mean scores of the groups on the Minnesota Teacher Attitude Inventory and the Purdue Teachers Examination. It was found that no significant difference existed in the mean scores on the three groups of the Minnesota Teacher Attitude Inventory at any of the occasions when the test was given during the two-term period of this study.

Using the data of the Purdue Teachers Examination, it was found that a significant difference at less than the five per cent level of probability existed among the groups at the first testing session. Multiple t tests showed there was a significant difference at the one per cent level of significance between the observation and control groups where $t = 2.87$. There was no significant difference between the reading group and either of the other two groups.

No significant difference in the mean scores of the three groups on the Purdue Teachers Examination existed on the two subsequent administrations of the test.

The interviews with the students in the reading and observation groups and the evaluations submitted by them indicate that, in the opinions of the students, there was a difference in their pre-student teaching experiences. All members of the observation group felt that they were better prepared for student teaching than were students in the other two groups. All students in the reading group felt they were better prepared for student teaching than students in the control group, but twenty-eight of the reading group expressed the opinion that they were not as well prepared as the students in the reading and observation group.

The opinions of the students in the reading and observation groups are not supported by their scores on the Minnesota Teacher Attitude Inventory and the Purdue Teachers Examination. If there were differences among the groups, the testing did not reveal that these differences existed. Microfilm \$2.75; Xerox \$7.80. 166 pages.

**ENRICHING SCIENCE THROUGH OUTDOOR EDUCATION. A RESOURCE GUIDE FOR TEACHING THE USE OF THE PARK IN THE ELEMENTARY SCHOOLS.
(PART I: THE INVESTIGATION.
PART II: THE RESOURCE GUIDE.)**

(Order No. Mic 61-2580)

Irving Joseph Weiss, Ed.D.
New York University, 1961

The purpose of this investigation was to develop a resource guide for elementary school teachers who wish to utilize New York City park facilities for the enrichment of science instruction in Grades K-6.

Five specific problems were developed in the investigation of the main problem. First, the values inherent in a science program as taught in the out-of-doors were determined. Second, the resources available in the city parks were recorded. Third, a list of basic concepts and understandings in science was compiled. Fourth, administrative procedures for field trips were established. Last, a resource guide for utilizing the out-of-doors was developed.

To determine the aims and values of a program of outdoor education, the investigator interviewed authorities in the fields of elementary education and science education. He employed the following questionnaire in the interview:

1. What do you think are the values of a program of outdoor education which makes use of parks for the enrichment of science?
2. How do these values affect the implementation of a program of elementary education?
3. How does a program of outdoor education enrich the learning experiences in science?
4. Is a program of outdoor education consistent with child growth and development? If so, how?

5. Does a program of outdoor education meet the child's needs and interests? If so, how?
6. What fraction of science time should be allocated for field trips?

The interview was supplemented by a review of the literature related to outdoor education. This included books in elementary education, science education, and child development; journals, yearbooks, periodicals, bulletins and theses.

The investigator made a survey of the resources available in fifteen New York City parks. Only the larger city parks, at least one hundred acres in area, were selected. Listings of these park resources appear both in the content of each unit and in the appendix of The Guide.

To compile a list of basic concepts and understandings the investigator reviewed courses of study, official bulletins and science textbook series. These concepts were listed on a master sheet and were categorized under living things, physical science and conservation.

A search was made of the laws, regulations and directives related to administrative procedures for field trips. The results of this research were discussed under liability, legislation, personnel, leadership, safety, transportation, distance, time and health.

The investigator then devised the following topical headings for each unit of The Guide: problem, basic concepts and understandings, aims, possible approaches, background for the teacher, preparation for the trip, experiences on the trip, enriching activities, possible outcomes, bibliography for the pupil, bibliography for the teacher, audio-visual aids, and a listing of free and inexpensive materials.

Chapter V, A Challenge to the Park Department, offers suggestions for an integrated program of the Park Department, school, home and community for the conservation of park resources.

Microfilm \$3.95; Xerox \$13.75. 305 pages.

EDUCATION, THEORY AND PRACTICE

**THE EFFECTS OF DISCUSSION GROUPING UPON SHIFTS OF PUPIL OPINION:
A STUDY TO DETERMINE THE EFFECTS
OF DISCUSSION GROUPING UPON THE
SHIFTS OF PUPIL OPINION ON SELECTED
PROBLEMS POSED TO SEVENTH
AND EIGHTH GRADE PUPILS.**

(Order No. Mic 61-2544)

Jack S. Bloomfield, Ph.D.
New York University, 1961

Chairman: Professor F. C. Borgeson

The Problem and Its Importance

The purpose of the investigation was to determine the effects of discussion grouping upon shifts of pupil opinion

on selected problems posed to seventh and eighth grade pupils. The investigator sought to discover whether there would be a greater shift and polarization of opinion among groups which were relatively closely-knit in relationships than among groups which were relatively loosely-knit.

The results of the experiment are expected to have some bearing upon classroom grouping practices and upon teaching techniques. Also, it is hoped that the data will provide insight into discussion, into the dynamics of communication, and into the process of attitude formation.

The Historical and Theoretical Background of the Problem

Previous research in the areas of discussion techniques, communication, attitude formation and group dynamics indicated the need for this study. The emphasis in this experiment was on the communicator himself and his relationships, whereas much previous research had concerned itself with techniques and content.

Collection and Types of Data

Pupils of thirteen classes of the seventh and eighth grades were the subjects of this experiment. Two classes on each grade, the middle ones in factors such as I.Q., reading, age, and mathematical ability, were considered control classes. The nine remaining experimental classes were tested through sociometric procedures and organized into thirty-six committees, four in each class. Two committees in each of the nine experimental classes in grades seven and eight were considered relatively closely-knit as evaluated by an index of cohesion and two committees were considered relatively loosely-knit. Altogether, there were eighteen relatively closely-knit groups, eighteen relatively loosely-knit groups and sixteen groups in the four control classes which were organized on the basis of random selection, for a total of fifty-two discussion groups.

The discussion groups met simultaneously to discuss and to vote upon three school problems which the votes would resolve. All pupils were given a nine-point annotated ballot ranging from "yes" to "no" before and after each discussion. The discussions were "leaderless" and lasted for a maximum of eight minutes each.

Analysis of Results and Conclusions

Through an analysis of variance of the scores on a nine-point scale and of those on a three-point gross scale, it was made clear that pupils in the potentially cohesive groups shifted their opinions more than did pupils in the potentially loosely-knit groups. The differences were shown to be statistically significant beyond the .05 level on both scales.

On the basis of an analysis of the distance of responses from the midpoint of the nine-point scale, pupils in the potentially cohesive groups shifted more toward decision at the poles than did pupils in the potentially loosely-knit groups. This difference was significant beyond the .01 level on the basis of a χ^2 comparison. On the other hand, when scales were used which had been weighted to show crystallization at the poles, an analysis of variance showed differences which were generally significant beyond the .05 level on one scale but not so on the other.

In summary, friendship ties had a decided effect upon

the amount of shift of opinion which took place after discussion. Though the shifts seemed to be more in the direction of decision for pupils in potentially cohesive groups than for the other groups, this was not completely resolved and needs further investigation.

Suggested Applications and Recommendations

Teachers should consider friendship constellations when organizing classroom committees. The purposes of the committees and the results obtained will be affected by the pupil relationships.

Further experimentation is recommended to discover more about the direction of opinion shift for different types of groups. Research in the field of discussion has concentrated on techniques, leadership and "atmosphere." More research is needed on the relationship among pupils to each other during classroom committee discussion.

Microfilm \$2.75; Xerox \$5.80. 118 pages.

AN EXPERIMENT USING WORLD HISTORY FILMS WITH SELECTED TENTH GRADE PUPILS: IMPLICATIONS FOR THE IMPROVEMENT OF TEACHING WITH MOTION PICTURE FILMS.

(Order No. Mic 61-2081)

Eugene Cottle, Ph.D.
Southern Illinois University, 1960

The problem of this study was to discover the kinds of teaching procedures involving moving-picture films in high-school classes and to evaluate the efficiency of these procedures for pupil learning.

Studies by Arnsperger and by Rulon in 1933, investigations under the direction of the American Council on Education, and research conducted by the United States War Department, among others, have directly or indirectly called attention to technique in the use of film as a factor in learning from films. Among the investigations especially referred to in this study are those by Arnsperger, Hovland and others, Jayne, May and Lumsdaine, Wittich and Fowlkes, and VanderMere. Reference was also made to studies of the intelligence factor as reviewed in the *Forty-Eighth Yearbook, Part I, National Society for the Study of Education*, and in the *Encyclopedia of Educational Research*.

This study grew out of a larger investigation in which films were used to supplement textbooks in tenth-grade world-history classes. Conclusions from that study were based on the results of pre-test and post-test achievement scores. In order to discover some of the implications for the improvement of teaching with films which might be derived from that study, the writer evaluated teacher responses to a questionnaire about their use of films. The teachers also responded in two questionnaires regarding teacher evaluation of the reactions of their pupils to films shown in relation to classwork. To discover further evidence of the efficiency of teacher use of films the writer made a comparison of the achievement scores of the top ten per cent ability level pupils in the experimental group with the top ten per cent ability level of the control group.

A comparison of achievement scores was also made of the bottom ten per cent ability level of both experimental and control groups.

It was concluded from this study that inefficient use of films does occur. Failure to preview films in some instances prevented proper application or relation to the current study topic. The writer sometimes noted a lack of enthusiasm or interest on the part of teachers and a failure to apply principles of psychology to learning situations. Teacher-dominated classrooms restricted pupil participation in the film showings. Teachers frequently did not plan adequately for the use of a film, and insufficient knowledge of film content resulted in the failure to integrate the film in the classwork. Teachers often did not allow enough time for a film showing and seemed to assume that a showing without anticipatory or follow-up activities would suffice. In some instances teachers were not aware of ability levels of individual pupils and consequently were unable to plan an effective use of films. From tests for significance of achievement it appeared that insufficient attention to individual differences was given by the teacher at both the top ten per cent and bottom ten per cent levels of ability. The study substantiated other research as to the contribution of films in teaching. It was found that the top ten per cent in intelligence of the experimental pupils achieved as much in one semester as the top ten per cent ability level of the control pupils achieved in the school year.

On the basis of this study the writer recommended that a greater use of films be made in high-school history classes; that teachers should become informed about the findings of research in the use of films; and that teachers make use of films to provide for the needs of the more capable and of the less capable pupils. The writer further recommended that colleges for teacher preparation use films more widely in their programs, not limiting a student's experience with films to the skill-developing courses in audio-visual education.

Microfilm \$2.75; Xerox \$7.00. 149 pages.

AN ANALYSIS OF THE PRACTICAL CONCEPTS CONCERNING THE ROLE OF SELECTED AUDIO-VISUAL COORDINATORS

(Order No. Mic 61-2573)

Albert Francis Doremus, Ed.D.
New York University, 1961

Purpose: This research was conducted in order to determine how the conceptions of the role of the audio-visual coordinator, as evidenced by opinion concerning the significance of his various practices, differ as among selected audio-visual coordinators, their administrators, teachers, and authors of selected literature in the field. Specifically, the study was designed to: (1) identify and classify the practices of audio-visual coordinators which are deemed significant in the opinion of audio-visual coordinators and their professional associates, (2) indicate similarities and/or differences of opinion concerning these practices among audio-visual coordinators and their professional associates, and (3) compare and analyze practices which are deemed significant in the opinion of audio-visual coordinators and their professional associates, with opinion

dealing with the same matters as found in selected literature in the field.

Procedure: Using an instrument developed by Kenneth C. Rugg, the investigator surveyed 104 school administrators, teachers, and full-time audio-visual coordinators in Connecticut, New Jersey, and New York. Opinions gathered concerning the performance and significance of practices of audio-visual coordinators were classified, analyzed, and compared. This data was related to opinions of authors as contained in seven recently published or revised texts and manuals dealing with the practices of audio-visual coordinators. Similarities and/or differences in conceptions of the role of the audio-visual coordinator were then identified and interpreted by the researcher.

Findings and Recommendations: The author of the study presents sixty-eight findings and twenty-three recommendations regarding the performance of 146 different practices of audio-visual coordinators. The findings deal with such specifics as the coordinator's administrative, supervisory, budgetary, consultative, evaluative, research, production, equipment maintenance, housing, clerical, in-service education, and public relations responsibilities. The recommendations suggest ways by which the full-time audio-visual coordinator's position may be strengthened and the effectiveness of his various practices improved.

Microfilm \$2.90; Xerox \$10.15. 222 pages.

DEVELOPMENT OF A REJECTION CLASSIFICATION FOR NEWER EDUCATIONAL MEDIA

(Order No. Mic 61-2825)

Gerhard Carl Eichholz, Ph.D.
The Ohio State University, 1961

In an effort to explain the lag between the introduction and the acceptance of an educational innovation, a theory of rejection was proposed. This theory was an outgrowth of prior work in mass media and motivational research as well as diffusion and adoption studies. The theory consisted of a nine-form classification of rejection. These forms were labeled ignorance, default, status quo, societal mores, interpersonal relationships, erroneous logic, substitution, self-fulfillment, and experience. An attempt was made to relate rejection to a time-to-adoption base, making rejection that action which preceded adoption. The relationship shown between stages in adoption and rejection was incorporated in the general theory of rejection.

The proposed theory of rejection was applied to the newer media in education. Twelve hypotheses that were related to teacher rejection or acceptance of the newer media were formulated. The purpose of the study was to show the validity of the proposed theory of rejection in the field of education.

The methodology of this study consisted of interviewing forty-five female elementary school teachers, and their principals, from five schools in a metropolitan area. The sample was selected on a three-point criterion: grade taught, years of experience, and their rejection of any or all of six designated audio-visual materials. The interviews

were partially structured, but the widest latitude in responses was allowed. A careful evaluation of the "climate" in which these teachers functioned was made, including the school, the Board of Education, and the general community.

Each interview was tape-recorded, and all the responses that related to either acceptance or rejection were transcribed. These transcribed responses were tabulated on the basis of twelve hypotheses dealing with rejection of audio-visual materials. This tabulation was made in two ways. One tabulation included rejection responses according to the cell structure used to select the sample. The results indicated that rejection did not seem to be related to teaching experience or grade taught. The second tabulation of rejection responses by the proposed classification schema substantiated a theory of rejection. Each form of rejection was expressed by at least 51 per cent of the teachers in relation to some innovation.

The proposed theory of rejection was revised on the basis of the data. The nine forms of rejection were reduced to five by the combining of forms that did not appear to be discrete: rejection because of ignorance, suspended judgment, and for situational reasons, personal reasons, and experimental reasons.

Certain limitations of the study were evident. Rejection was not generalized over the total range of audio-visual materials, nor did the grade level or years of teaching experience account for rejection as supported by previous studies. Certain concepts, such as time-to-adoption scale and stages of rejection, were not substantiated because of lack of data, and therefore are areas for further research. Certain practical suggestions with general applicability were made on the basis of peripheral information uncovered during the interviews. In general, the study developed a basic framework and identified both the area and the problems for the further study of rejection.

Microfilm \$2.75; Xerox \$9.45. 207 pages.

the Vineland Social Maturity Scale. The data were analyzed to determine statistically significant differences among the low, middle, and high groups in the areas of social and academic growth.

The findings in this study indicate both social and academic changes in the subjects as reflected in the test data. The middle and high groups made statistically significant gains over the low group in Vineland Social Maturity Quotients during the experimental period. In academic areas the high and middle groups showed statistically significant gains over the low group. The analysis of the data on the drawings yielded statistically significant agreement that there were growth in maturity and less emotional disturbance for the total group. However, the differences among the low, middle, and high groups were not statistically significant either in growth in maturity or in emotional adjustment. The Goodenough Intelligence Quotient data indicated that the high group made statistically significant gains in mental growth. When the subjects were divided into high and low mental age groups, the final drawings showed no statistically significant differences in gain between these two groups. Although not a statistically significant difference, there was a tendency for those in the younger chronological age group to show greater gains than those in the older chronological age group.

These results were interpreted to demonstrate that, over a two-year period in public school classes, social and academic changes within this group of trainable children did occur. Those who ranked in the low group in social maturity at the beginning of the experiment tended to make the least social and academic gains. Greater gains in mental growth tended to be made by those in the younger chronological age range. All groups apparently showed less emotional disturbance at the conclusion of the study.

Further research is needed in the construction of instruments adapted to mentally retarded subjects and in the evaluation of specific teaching techniques and curricula.

Microfilm \$2.75; Xerox \$5.20. 103 pages.

A STUDY OF CERTAIN CHANGES WITHIN A GROUP OF THE TRAINABLE MENTALLY RETARDED

(Order No. Mic 61-2863)

Margaret Jane S. Green, Ed.D.
The University of Oklahoma, 1961

Major Professor: Dr. Percy T. Teska

This study was designed to determine the social and academic changes within a group of trainable mentally retarded children during a two-year period in public school classes. It was hypothesized that there would be no statistically significant differences among the low, middle, and high groups ranked according to Vineland Social Maturity Quotients obtained at the first testing period.

Twenty boys and girls served as subjects: ten boys and ten girls with chronological ages ranging from nine through nineteen years; and with intelligence quotients of thirty through fifty-six. The instruments used to measure social and academic changes were: Metropolitan Readiness Test; Metropolitan Achievement Test, Primary Form; House-Tree-Person Test; Machover Drawing Test; and

THE EVOLUTION OF THE SECONDARY MATHEMATICS CURRICULUM: A CRITIQUE.

(Order No. Mic 61-1010)

John David Hancock, Ed.D.
Stanford University, 1961

Purpose and Methods of the Study

At the present time several influential projects are underway with the intent to modify the secondary mathematics curriculum. Teachers with curriculum responsibilities, writers of current proposals, and professors and students of mathematics education need guidance and direction in order to profit directly from project results. This study is designed to provide a transition from earlier recommendations to the present ones. The distinguishing characteristics of eight different reports (starting with the Committee of Ten) and three current projects have been identified. This approach has been designed to provide the perspective by which the current proposals can be better understood.

Specifically, the purposes of this study may be outlined as follows:

- (1) To ascertain the various aims of and recommendations for secondary mathematics from 1893 to 1960, as specified by various national committees concerned with the topic.
- (2) To trace the history of the major individual aims and recommendations throughout the period being studied.
- (3) To ascertain the particular aims and recommendations of the principal curriculum revision groups which are active at the present time; to highlight the differences among these groups; and to suggest research needed to resolve these differences.

The projects included in this study were those that: (1) devote their principal emphasis to the mathematics curriculum for grades 9-12, (2) are recipients of foundation grants to facilitate procurement of qualified staff members and to insure operating funds, and (3) have several publications in print which pertain to their work. Selected for the study were the following current curriculum revision projects: the University of Illinois Committee on School Mathematics, the School Mathematics Study Group, and the Commission on Mathematics of the College Entrance Examination Board.

As background for the study, the national committee reports on secondary mathematics were reviewed together with other relevant supplementary writings by authors of stature in the field. Each committee report was studied from the following four points of view: committee organization, aims for instruction, recommendations for content, and recommendations for methodology. The current projects were analyzed and reported from the same points of view.

Summary of Findings

Regarding Aims for Instruction

It became clear in the course of the analysis that attention to aims has depended upon the current need to justify retention of mathematics in the secondary curriculum. In periods when the society does not see a pressing need for the study of mathematics, emphasis is placed on the utilitarian aims of instruction, providing the nation's economy has been industrially active. During periods of economic depression cultural aims were emphasized. When need for mathematics instruction is clearly evident, on the other hand, attention to aims has diminished and there has been a tendency to assume that whatever mathematics could be taught was justifiable.

Regarding Methods Recommended

Despite the close logical relationship among aims, content, and methods, the latter have received comparatively little attention by the national committees or current projects.

Regarding Content Recommended

Elementary algebra in some form or other has been recommended for the ninth grade by all committees

reporting throughout the past seven decades as well as in current project reports. Likewise, demonstrative plane geometry has been recommended for grade 10. However, greater variety is found in recommendations for the junior and senior years. Although advanced algebra, solid geometry, and trigonometry in some order have frequently been recommended, a sprinkling of other courses have also been suggested. Integration of related fields of mathematics has been proposed from time to time. Current proposals renew this suggestion and at the same time place greater emphasis on mathematical structure and logical development.

Microfilm \$2.75; Xerox \$7.60. 163 pages.

AN EXPERIMENTAL EVALUATION OF TWO CURRICULUM DESIGNS FOR TEACHING FIRST-YEAR ALGEBRA IN A NINTH GRADE CLASS

(Order No. Mic 61-2864)

M. LaVerne Loman, Ph.D.
The University of Oklahoma, 1961

Major Professor: William R. Fulton

The purpose of this study was to investigate the effectiveness of one of the most prominent of the contemporary algebra programs as compared to the traditional algebra program for teaching the basic mathematical concepts of first-year algebra in a ninth grade class. The effectiveness of the two programs was measured through a statistical analysis of test scores in three areas of achievement: (1) the understanding of basic mathematical concepts, (2) mathematical abilities, and (3) manipulative skills.

Two classes of ninth grade students enrolled in first-year algebra, the middle track of a three-track program, at West Junior High School, Norman, Oklahoma, served as subjects for this study. One class, using the state adopted text with the traditional method of teaching, was taught by a regular member of the West Junior High School faculty. The other class, using the text developed by the University of Illinois Committee on School Mathematics with the discovery method of teaching, was taught by the researcher. The study covered the full school year, 1959-1960.

A null hypothesis was stated for each of the three areas of achievement. The scores made by each group on the UICSM pre-test and post-test, Test of Understanding Basic Mathematical Concepts, the Mathematics Test of the Sequential Tests of Educational Progress, and the Cooperative Elementary Algebra Test were compared by means of the t-test and analysis of variance with the following results:

1. A statistically significant difference in the understanding of basic mathematical concepts in favor of the group using the contemporary program was obtained at the upper one-third intelligence level. No real difference was found between the two groups at either the middle or the lower one-third intelligence level.
2. No apparent difference was found in the achievement of mathematical ability between the two groups at any level of intelligence.
3. No apparent difference was found in the achievement of manipulative skill between the two groups at any level of intelligence. Microfilm \$2.75; Xerox \$3.00. 54 pages.

THE CONFERENCE AS A METHOD IN THE TEACHING OF ENGLISH COMPOSITION IN THE JUNIOR-SENIOR HIGH SCHOOL

(Order No. Mic 61-2558)

James Joseph Lynch, Ph.D.
New York University, 1961

The study sought to test the use of individual theme conferences as a method in the teaching of English composition in a junior-senior high school. Randomly selected students of the Pelham Junior-Senior High School, Pelham, New York, in addition to attending regular English classes, were scheduled for a ten-minute conference every two weeks, at a time when their study hall period coincided with the free period of their English teacher.

The investigation was designed to test the writing achievement of conference students in comparison with that of matching non-conference students of the same teachers and in the same classes, and to obtain the opinions of the students, teachers, and administrators concerning the effectiveness of the conference program. The students' evaluations of the program were obtained through both free response written comments and a questionnaire which concerned the attitudes of the students toward the conferences, their feelings about their relationships with the teachers in the conferences, their opinions about the administration of the program, and their opinions regarding their improvement in writing as a result of the conferences.

Before the conference program was initiated and after it was concluded, the conference and non-conference students were tested by the use of a STEP Essay Test, a composition scale type of test published by Educational Testing Service wherein students write freely on a single subject and are rated according to a comparison of their essays with model essays. The essays are scored on the basis of 50% for quality of thought, 30% for style, and 20% for conventions.

The evaluations of the program by the teachers were obtained by means of a questionnaire which concerned their attitudes and personal feelings regarding the conferences, their opinions of the administration of the program and its physical facilities, their procedures in conducting the conferences, and their observations of student reactions, of student improvement in writing, and of time factors in holding the conferences.

The opinions of the administrators, obtained by interviews, concerned the practicality of the program and its staffing, the feasibility of scheduling conferences for all students, the reaction of the public to the program, and the utilization of the conferences for teaching composition in the future.

Analyzed by the use of the chi-square formula, the questionnaire responses of 136 conference students showed their opinions to be in favor of the conferences as a method of learning. In the general aspects of the program stated above, the attitudes of the students were shown to be statistically in favor of the conference method. The free response comments written by the students supported these findings.

The testing results, statistically analyzed by the use of the F formula for differences between groups, showed that 108 conference students achieved a significantly better total score than did the matching 108 non-conference students.

The responses of the teachers to the questionnaire showed that, in general, seven of the nine participating teachers believed the conferences to be effective, and preferred them as a method in the teaching of composition.

The three administrators interviewed regarded the conferences favorably as a method of teaching composition, and they believed that it was feasible and desirable to expand the conference program to include all students.

In this comparison of the theme conference with the conventional method of written comments on themes in the teaching of English composition, the writing achievement of students receiving conferences was greater as measured by the STEP Essay Test, and students, teachers, and administrators expressed opinions more favorably to the theme conferences. The investigation suggests further experimentation and practice in refining techniques and in improving the administration of the conference method.

Microfilm \$3.40; Xerox \$11.95. 264 pages.

THE RELATIVE MERITS OF SEVERAL METHODS OF TEACHING PROBABILITY IN ELEMENTARY STATISTICS

(Order No. Mic 61-2559)

Evan Merle Maletsky, Ph.D.
New York University, 1961

The Purpose

The purpose of the experiment was to test the relative merits of three methods of teaching certain topics in elementary statistics. The first method included a formal introduction to the theory of probability using the basic concept of sets. The second included a formal introduction with emphasis on traditional mathematics. The third method included a very short, intuitive introduction to probability. The experiment was designed (1) to describe these three distinct methods of teaching probability; (2) to compare the effects of the two methods using formal introductions on problem solving ability in elementary probability; and (3) to compare the problem solving ability of three groups in certain topics in statistical inference, each group receiving a distinct method of teaching probability.

The Procedure

Three probability units were prepared. The first unit, basing probability upon the elementary theory of sets, used the operations of union and intersection in establishing the rules applied to compound and conditional probabilities and in defining mutually exclusive and independent events. Combinations were treated in terms of subsets of a given set. Probabilities were assigned to elements in the sample space, and problems were solved using Venn diagrams and complementation. A short unit on the concept of sets and related notation preceded the probability unit.

The second unit, following the traditional approach, established the fundamental rules of probability on the operations of addition and multiplication with verbal definitions of independent and mutually exclusive events and conventional counting procedures used throughout. The

The third unit, lasting only one period, included only a brief, intuitive introduction to probability.

The tests used in the experiment were constructed by the researcher. The control variable, mathematical competencies, was measured by a test constructed from questions selected from a textbook on the topic. A survey was made of textbooks on elementary mathematics and probability, and from them a collection of problems were chosen for the probability test. Pilot test results were subjected to an item analysis. The final form of the test was given to the two groups receiving the formal units on probability. Questions used in the statistical inference test were also chosen from selected textbooks in the field and pilot tested.

The three groups used in the experiment were essentially random samples of a total of twelve sections of a one-semester elementary statistics course for non-mathematics majors offered that semester at Montclair State College. The group receiving the modern approach had twenty-five students; the remaining two groups, thirty and twenty-eight. Throughout the experiment the teaching of all groups was done by the researcher.

Results and Conclusions

An analysis of covariance was performed on the results of both the probability and statistical inference tests. Statistical control of the concomitant variable, scores on the mathematical competencies test, was gained through the use of the analysis of covariance design. Results indicated that the modern and traditional approaches to teaching probability in a two-point elementary statistics course for general non-scientific students failed to produce statistically significant differences at the five per cent level in problem solving ability in probability. The results also indicated that differences in problem solving ability in areas of statistical inference for general non-scientific students failed to be statistically significant whether the modern or traditional approach or only a brief, intuitive introduction to probability was given. Results were, however, in favor of the modern approach using sets.

Microfilm \$2.75; Xerox \$8.00. 171 pages.

THE REQUIRED PROGRAMS OF GENERAL EDUCATION IN THE SOCIAL SCIENCES AT COLUMBIA COLLEGE, THE COLLEGE OF THE UNIVERSITY OF CHICAGO, AND HARVARD COLLEGE.

(Order No. Mic 61-1087)

Charles Hoover Russell, Ph.D.
Columbia University, 1961

This study concerns the way the colleges at Columbia University, the University of Chicago, and Harvard University have adapted the social science disciplines and university resources in teaching and administration to achieve the goals of general education. Primary focus falls on the distinguishing features of the courses and their origin and evolution.

The introductory section of the study presents the origins of general education and its underlying concepts, the setting for general education at the three colleges, and a

discussion of initial moves. An examination of the social science courses and identification and comparison of the distinguishing features of the three programs follows. Two chapters consider teaching and administration respectively. The conclusions take up the significance of the programs for other colleges, their long-term contributions to higher education, and their relevance to the current demand for emphasis on science and intellectually demanding studies and for accelerating the completion of the college program.

The social sciences form part of an offering which embraces the sciences and humanities at Chicago and Harvard, and the humanities at Columbia. The study reveals that practices with respect to the number of courses required, selection and organization of subject matter, and teaching appear to relate to the institutional setting of the programs. Chicago developed a carefully articulated three course sequence, now oriented to political theory, within its independent college and under the direction of a staff primarily involved in teaching general education. Restoration of the divisions, whose concern it is to teach advanced and graduate courses, to a measure of control over the college effected some changes and will very likely have further results. Leadership in the Columbia program came from history and philosophy, and the two course sequence, taught by individuals who hold appointments in departments that offer graduate as well as undergraduate instruction, aims to develop a broad perspective on contemporary society. The Harvard courses all show a relationship to the report of 1945, General Education in a Free Society, but because they are directed by individuals, most of whom hold departmental appointments and have established reputations as scholars, and only generally supervised by the powerful Committee on General Education, they represent individual approaches.

The courses stress the development of the student's insight and intellectual ability. They draw freely on all the social science disciplines. Initially the Columbia and Chicago courses ranged over the social sciences and attempted to integrate them. At present the courses represent original inquiries which develop inclusive understandings through a focus on fundamental questions. Reading original sources, which stress ideas and place emphasis on the student's ability to grasp meaning and make interpretations, appear to make possible the use of the insights developed by the disciplines without separate study of each. Teaching emphasizes activation of the student's mind so that discussions figure prominently at Columbia and Chicago and writing of essays at Harvard. The function of administration is best described as making the resources of the university available for purposes of general education.

The author concludes that the programs: (1) offer other institutions examples rather than models; (2) have made numerous long-term contributions to higher education; (3) continue to have value in light of present demands on higher education.

Similar studies ought to be done in the humanities and sciences, and extended to include other types of colleges. There should be special inquiries into the place of the various disciplines, especially philosophy in general education. The philosophy of general education and its impact on the organization of courses and programs needs attention. Microfilm \$3.60; Xerox \$12.60. 280 pages.

**TENTATIVE PROPOSALS FOR GUIDANCE
AND COUNSELING IN IRAQI
SCHOOLS AND COMMUNITIES**

(Order No. Mic 61-2340)

Naim Yousif Sarafa, Ed.D.
Wayne State University, 1961

Adviser: Joseph E. Hill

Background of the Study

Iraq was occupied by England in 1918. Iraq schools were closed during World War I, and the post-war government agency was charged with responsibility of re-opening the schools.

Emergency teacher training programs were established in 1918 and were gradually expanded until 1932, when Iraq became independent. From that point there has been a gradually increasing number of teachers trained for elementary and secondary school work. Although the teacher training programs have steadily improved work in guidance and counseling has not been included in the offerings. Consequently, guidance and counseling programs are non-existent in the Iraq school system today.

Purpose

The purpose of this study was to identify principles of guidance, and propose plans for guidance programs at all levels of education involving the teacher, the administrator, and community.

Significance of the Study

This study has national significance for Iraqi guidance and counseling in teacher education, child growth and development, and the general standard of living.

Questions to be Answered

This study attempts to provide answers to the following general questions:

1. What are the stages of education in Iraq?
2. What are persistent problems of youth and adults which guidance and counseling may alleviate?
3. Does the teacher training program in Iraq fulfill the educational aims of guidance and counseling which stress the preparation of citizens?
4. What is the aim of guidance and counseling in American school programs?
5. (a) How can the guidance and counseling services in Iraqi schools be improved based upon the American system?
(b) How can Iraqi teachers be prepared for guidance and counseling in Iraqi schools?

Design and Procedures of the Study

The source of data for this study was:

1. Information from the Iraq government, Baghdad University, and Wayne State University.
2. The experience, visitations of various American school systems, and the writer's educational program at Wayne State University.

The treatment of the data of this study was carried on in two main categories: (1) Organizing data toward a basic program for preparing school staff for guidance and counseling services, (2) Sorting materials on the basis of a plan for providing guidance services in Iraqi education.

Presentation of the Proposed Plans

The proposed plans were discussed in three parts:

1. The existing conditions in elementary, secondary, and teacher education schools in Iraq.
2. The proposed plans and the basic principles of guidance which should be incorporated at all levels of Iraqi school system.
3. The implementation of the proposed plans in the Iraqi schools.

Conclusions

From the data presented by the study, flexible proposed plans for guidance in Iraqi schools were developed, and the five general questions of the study were answered as follows:

1. The data of the study shows that there are seven basic stages of education in Iraq: kindergarten, primary, intermediate, preparatory, teacher training, vocational, and higher education.
2. The problems of Iraqi youth and adults which the guidance and counseling programs help to alleviate are:
 - a. The complicated examinations
 - b. The complicated textbooks and curriculums
 - c. Emotional and psychological problems
 - d. Physical and health problems
 - e. Financial and behavior problems
3. The teacher training programs in Iraq do not fulfill the educational aims of guidance and counseling, because the teacher training institutions in Iraq do not offer courses in guidance and counseling.
4. The purpose of guidance and counseling in American school programs is to assist the "whole" student in his development and adjustment, to help him meet and solve his problems.
5. (a) The guidance and counseling services depend upon preparing teachers for counseling work. (b) The teachers can be prepared by organizing guidance and counseling programs in teacher training curriculums.

Microfilm \$3.40; Xerox \$11.95. 263 pages.

**THE POSSIBLE CONTRIBUTION OF THE
FIELD OF GUIDANCE TO THE EDUCATIONAL
SYSTEM IN EGYPT, UNITED ARAB REPUBLIC.**

(Order No. 61-2981)

Shatha A. Shakhshiri, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor John W. M. Rothney

The study is historical and descriptive in nature. It is a factual exposition and situation analysis leading to a theoretical construct. In this study an attempt was made to point out the urgency of providing guidance and counseling

services in the educational system in Egypt, the United Arab Republic. The social, sociological and psychological elements which constitute the cultural frame of reference of the individual citizen were presented. The national needs of the country, as well as the personal needs of the citizen were discussed. It was demonstrated that the main problem, on the national level, is the maximum utilization of the natural resources for the purpose of increasing the national wealth and raising the standard of living. On the individual level, the main problem of the Egyptian seems to be that of developing a more adequate personality, the attributes of which are openness to experience, identification with others, and creativity.

The nature of guidance and counseling, two of the individualized and personalized services in education, was discussed. It was demonstrated that the term guidance as a viewpoint must be distinguished from guidance as an organized program. The confusion, in the United States about the use of the same term to indicate both ideas, could be avoided in Egypt if the necessary measures are taken to separate the two concepts. It was shown that this might be accomplished by professionalization of the guidance field, and effectual training of guidance personnel.

In harmony with the framework of the phenomenal field of the individual, the author showed that the client-centered was the most appropriate approach for the development of the adequate personality. It was suggested that the counselor, who is the key to the success of the whole guidance program may give personal and environmental support to the individual student through his training, personal maturity and sensitivity. By means of counseling, the individual may be helped in studying himself and his opportunities for the purpose of making satisfactory plans. It has been shown that counseling provides the individual with the opportunity to get rid of the negative elements in his life and to increase the chances of his success. It has been suggested that it may also assist the individual student in internalizing the value system of his country and in developing a feeling of group cohesiveness.

On the basis of a position taken on the philosophy and principles pertaining to the field of guidance and counseling in the Egyptian public schools, the author recommended a program designed to fit the Egyptian scene. Practical considerations relevant to the inauguration of a program of guidance services in the education system in Egypt were presented.

Microfilm \$3.80; Xerox \$13.30. 294 pages.

USE OF TEACHER-PRODUCED INSTRUCTIONAL FILMS IN INDUSTRIAL ARTS EDUCATION: A STUDY TO DETERMINE THE EFFECTIVENESS OF TEACHER-PRODUCED INSTRUCTIONAL FILMS IN TEACHING PERCEPTUAL-MOTOR SKILLS IN A PUBLIC SCHOOL INDUSTRIAL ARTS SHOP.

(Order No. Mic 61-2576)

Vance Beidel Snyder, Ed.D.
New York University, 1961

Chairman: Professor William P. Sears, Jr.

PURPOSE: This study was concerned with determining the effectiveness of teacher-produced instructional films for use in industrial arts education. In the development of this study the following steps were undertaken: (1) To select a teaching environment in a public school industrial arts shop, (2) To equate two groups of students for the experiment, (3) To develop teacher demonstrations parallel to those of the teacher-produced instructional films, (4) To develop criteria for determining success in learning perceptual-motor skills presented in the teacher demonstrations and teacher-produced instructional films and (5) To identify the relative effectiveness of both techniques of presenting industrial arts motor skills.

PROCEDURE: Employing the criteria developed for the selection of a teaching environment, a public school industrial arts shop was selected for the purpose of this study. From the total student population of this teaching environment, two groups were selected at random to serve as the control and experimental groups. Both groups were equated in relation to reading ability, mechanical ability and previous industrial arts experience. Two class sections composed each group with a total enrollment of thirty-two students. The control group was not subjected to the experimental factor, but had the demonstrations presented in the traditional manner by the investigator, whereas the experimental group was shown the teacher-produced instructional films covering the same subject matter. The students of both groups constructed projects that required the use of the perceptual-motor skills presented by both methods of instruction. The completed projects were then evaluated by a jury of industrial arts educators in order to determine the effectiveness of the two methods of instruction.

RESULTS: The basic hypothesis of this study, that a teacher-produced instructional film would teach a perceptual-motor skill more effectively than the live demonstration method of industrial arts instruction, was not proved. In thirty-two of the forty-three operations evaluated by the jury, resulted in the acceptance of the hypothesis that the students of the control group and the experimental group did not differ in their performance of the specific perceptual-motor skill. As a result of the jury's evaluation of the remaining eleven operations, it was found that the students of the control group did superior work, this demanded the rejection of the hypothesis that the students of both groups did not differ in performance.

In addition, all observed values of *p* for the forty-three different operations resulted in a score of .500 or better.

Again, this indicated that better workmanship was performed by the students of the control group.

Both methods of instruction have a definite place in the teaching of industrial arts. The influence of the personal contact between the demonstrator and the students during a live presentation cannot be overlooked in the evaluation of this type of teaching technique. At the same time, one must not turn 'thumbs down' on the film presentation, for as evidenced in this study the use of magnification of minute details is an important factor in teaching a perceptual-motor skill to students of industrial arts.

Microfilm \$2.75; Xerox \$8.40. 185 pages.

**A GUIDE TO PRINCIPLES OF
CREATIVITY-IN-TEACHING WITH
SUGGESTIONS FOR USE IN ELEMENTARY
SOCIAL STUDIES. (PARTS I AND II).**

(Order No. Mic 61-2577)

Edward Fred Stone, Ed.D.
New York University, 1961

The problem: to formulate for classroom teachers a guide to general principles of creativity-in-teaching and to provide suggestions for their use in the elementary school social studies program through an analysis of selected teaching situations.

Related literature showed that despite a history of general interest in creativity the school has much to do in order to further promote creative expression. Related research studies supported the value on an interdisciplinary approach to creativity; related doctoral studies supported the need to define the nature, characteristics, and significance of creativity.

Procedures: (1) Literature concerning creativity as it related to elementary curriculum and as obtained from the areas of child growth and development, educational psychology, and the arts was reviewed in order to formulate general principles applicable to the elementary school. After a review of the literature had been completed fifteen principles of creativity-in-teaching emerged. They were regarded as a representative summary of literature concerning creativity as pertaining to the needs, purposes, and philosophy of the elementary school. (2) Seven main suggestive illustrations of the general principles of creativity-in-teaching in social studies learning situations were obtained from the public schools of Great Neck, New York. The seven teachers, Kindergarten through Grade Six, who provided the illustrations were evaluated as professional and creative people according to criteria

established by the investigator and supported by a jury of school personnel. The illustrations validated and showed a relationship to the general principles through a reporting of examples of successful application in an actual classroom situation. Forty-eight additional illustrative examples of creative teaching were then obtained in an attempt to implement suggestions for improving one's creative powers as a step toward widening and deepening the ability to live more richly as given in a report of The National Council For The Social Studies entitled "A Guide To Content in The Social Studies." (3) A guide for elementary teachers was then written. It represented an attempt to stimulate teachers to work more creatively in the classroom and included a summation of the theory of the creative process translated into a functionally suggestive record of certain experiences that have been offered children in order to help them deal with the social studies more creatively.

The fifteen general principles of creativity-in-teaching summarizing the theoretical framework of Part I of the investigation and serving as the basis for the suggestive application recorded in Part II now follow.

1. Creative expression has both social and personal significance and should be fostered in the elementary school.
2. All children are capable of creative expression to some degree.
3. Creativity is a complex process involving a concept of one's self and relating to one's environment.
4. Preparation, activity, time, and flexibility of thought aid the production of a creative product.
5. Evaluation aids the completion of a creative product.
6. Children may show differences in both degrees and areas of creativity.
7. An adventuring attitude incorporating effort and experience is characteristic of creative expression.
8. Imagination is characteristic of creative expression.
9. Creativity may be developed in all subject areas, in all school endeavors, and may involve any media or mode of expression.
10. The creative teacher utilizes learning principles to promote creative expression.
11. The creative teacher stimulates creative expression through his own attitude and example.
12. The creative teacher provides experiences, concepts, and skills as a basis for creative expression.
13. The creative teacher stimulates creative expression within a democratic environment.
14. The creative teacher values process as well as product.
15. The creative teacher utilizes problem solving as a basis for further creativity.

Microfilm \$3.75; Xerox \$13.05. 290 pages.

ENGINEERING

ENGINEERING, GENERAL

REGULATORY POLICIES ON LIBERALIZED DEPRECIATION AND THEIR EFFECTS UPON PUBLIC UTILITIES

(Order No. Mic 61-2271)

Gerald Wavern Smith, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisors: Harold A. Cowles and
Joseph K. Walkup

In 1954 Congress authorized certain revisions to the federal income tax regulations including allocation of depreciation by "liberalized" methods; their intent was to stimulate new investment through tax savings. The effect on public utilities is shown by presentation of:

1. History and current practice of regulation.
2. Depreciation concepts and the dependence upon purpose.
3. Depreciation accounting purposes, practices, procedures, and methods. Also the effect of growth, mortality dispersion, grouping, and service life.
4. Rate making procedure and the arithmetic of rate determination.
5. Commission policy on the handling of "tax savings" in rate-making proceedings.
6. Survey information on utility and industrial firm practices.

The author contends that "Regulatory rate-making policy can discourage a utility from adopting a liberalized depreciation method for federal income tax purposes." The contention is supported primarily by the author's survey of 221 utility firms and 120 industrial firms. The supporting evidence is:

1. Utilities in the "flow through" (or "other") policy states have adopted liberalized methods in a smaller percentage (statistically significant at the 95% confidence level) of cases than have utilities in the "normalize" policy states.
2. Utilities in California, Minnesota, Missouri, North Carolina, Pennsylvania, and Wisconsin have adopted liberalized methods in a smaller percentage (statistically significant at the 95% confidence level) of cases than have the non-regulated firms of all states.
3. Sixteen of 29 utilities explain their non-use of liberalized methods by blaming regulatory policy, lack of policy, or uncertainty as to the application of policy.
4. At least seven utilities have abandoned liberalized methods coincident, or nearly so, with rate proceedings.
5. At least five utilities have "split" policies, using liberalized methods for properties located in "normalize" policy states and conventional methods in "flow through" and "other" policy states.

Instead of restricting benefits to the present consumer, ill-advised regulatory rate-making treatment of tax savings

can and does deny the probable benefits to present and future consumers, stockholders, and employees. In Pennsylvania, for example, only four of 14 utilities (29%) reported use of liberalized methods; the national average for utilities was 73% and for industrials was 75%. It is ironic that the majority of persons to whom the probable benefits are denied are residents of the very state which supports the action of its regulatory commission.

It seems that improved rate-making policy should be:

1. Designed so as to avoid discouraging a public utility firm from adopting a liberalized method of computing depreciation for federal income tax purposes.
2. Clearly defined and consistently applied.
3. Reasonable in the distribution of the gains or losses resulting from use of the liberalized methods among the present and future consumers, stockholders, and employees. Microfilm \$2.75; Xerox \$7.80. 168 pages.

THE ROLE OF THE CONCEPT OF STATISTICAL STABILITY IN ORGANIZATION THEORY

(Order No. Mic 61-2669)

Roger L. Smith, Ph.D.
Columbia University, 1959

This dissertation develops a concept of organization which will permit the executives responsible for the management of an industrial organization to make operationally valid measures of the characteristics of the organization and of its state of organization. With this concept developed into a reality these executives will be enabled to more effectively operate their organization in order to attain specified organizational objectives, the objectives themselves clarified by the operational means of attaining a specified state of organization.

This state of organization is in reality the degree to which the organization operates as a unified entity, the organizational process. The degree of homogeneity and stability, which are the measure of the state of the organization, pervades the whole organization and all its functioning and serve as a basis for recognizing assignable causes of variation in the organizational process. Therefore, the concept of stability in the organizational process operates in a dual manner. When the stability itself is recognized it will allow the managers to recognize organizational stability and thereby provide clues for routine decision making and greater and greater effectiveness of operation. At the same time the measure of stability of the organizational process will serve as a basis for determining assignable causes of variation which when recognized will be a signal indicating a need for a change in policy or decision making.

This dissertation proposes that in an industrial

organization's specific functioning that the aspects of statistical control provides effective operational means for obtaining specific organizational objectives such as product quality, production rate, cost control, etc. More important, the dissertation attempts to show that the state of organization, the degree of statistical stability of the total organizational process can be measured and more effectively achieved by actively using the concepts of statistical control and by providing some criteria for judging the degree of statistical stability of the whole complex organization. It should be noted that the term statistical stability and statistical control are not used interchangeably. Statistical stability refers to the state of a process and statistical control refers to the means of attaining that state.

The role of the concept of statistical stability in organization theory is developed through the medium of W. A. Shewhart's statistical control cycle of specification (organizational objectives and individual goals), production (the means of attaining and recognizing the state of organizational stability), and evaluation (the check to see if the objective or goal has been reached). By means of this medium it is developed that specifications for an industrial organization are primarily dependent on the wants and desires of the individual and the capabilities of the total organizational process in terms of individual wants and desires. Goals and objectives are separate but interrelated concepts. Goals are proposed as individualistic in nature and are operationally expressed in terms of the individual's wants and desires. Objectives are proposed as organizational in nature; they are proposed as the wants and desires men set by conscious choice within the framework of the organization. Based on these assumptions the control chart criterion for organization is introduced which uses individual goals measured as individual wants and desires and considered as the within sample variation to determine the limits of the total organization process; and organization objectives measured as wants and desires and considered as between sample variation to determine, together with the limits just specified, what variation is inherent to a specific organization and what variation is due to assignable causes. When this control criteria is integrated into the statistical control cycle, and the industrial organization is considered as operating within this cyclic concept, statistical stability emerges as an operational concept of industrial organization theory.

Microfilm \$3.00; Xerox \$10.60. 231 pages.

ENGINEERING, AERONAUTICAL

STAGNATION POINT FLUCTUATIONS AND BOUNDARY LAYER STABILITY ON BODIES OF REVOLUTION WITH HEMISPHERICAL NOSES

(Order No. Mic 61-2740)

Gage Houston Crocker, Ph.D.
University of Michigan, 1961

Velocity fluctuation measurements were made with a hot-wire anemometer in the nose region of three bodies of

revolution with hemispherical noses. Measurements made in a low turbulence tunnel at Reynolds numbers up to 2.5×10^6 show that streamwise fluctuations in velocity near the nose exceed those of the free stream up to distances of the order of 50 times the boundary layer thickness. The region of greater relative turbulence extends further from the nose at a Reynolds number of one million than it does at a Reynolds number of two million. This Reynolds number effect suggests that the boundary layer plays a role in the coupling between the magnitude of the fluctuations and the motion of the stagnation point.

A negative spatial correlation between velocity fluctuations measured at two positions on opposite sides of the stagnation point ($\Phi = 7^\circ$) indicates that the turbulence in the stagnation region is identified with a random motion of the stagnation point. One measurement on a sphere at a Mach number of 2.44 indicates a similar flow phenomena at supersonic speeds.

Measurements at a reference position outside the boundary layer 7° from the stagnation point reveal that a large part of the energy of the velocity fluctuations near the nose is in the low frequency portion of the spectrum, in marked contrast to spectral characteristics of the free stream turbulence. The normalized energy spectra scale with the wave number of the fluctuations over a ten-fold range in body diameter and 40-fold range in Reynolds number. From the results obtained, it was concluded that the spectral distribution of the fluctuation energy is independent of model diameter and Reynolds number of the flow. The magnitude of energy fluctuations at the same point ($\Phi = 7^\circ$) on different sized models, relative to the free stream turbulence, was found to vary as the minus one-fourth power of the model diameter over the same range of diameters and Reynolds numbers.

Some measurements were made of the response of the boundary layer on the nose to small and large disturbances. Large disturbances, generated by a rotating rod in the stagnation region, were rapidly damped as they progressed over the nose. Heating the surface in the stagnation region had no detectable effect on this high rate of decay of the disturbances. A fixed pin normal to the surface at $\varphi = 40^\circ$ was found to cause transition if its roughness Reynolds number, $U_{k\bar{k}}/\nu$, was at least 610. A similar pin oscillating in and out of the boundary layer caused trailing vortex-like disturbances which progressed downstream at a higher relative speed than did those from a two-dimensional disturbance. Sudden changes were observed in the rate of separation of these vortices as they progressed downstream over the nose.

Phase measurements and the determination of phase velocities of two-dimensional disturbances in the boundary layer due to a vibrating wire indicated the presence of a dominant (stable) mode plus other stable modes. When the wire amplitude exceeded a certain threshold value, the fluctuations immediately behind the wire assumed a random rather than sinusoidal character taken as the onset of transition.

In conformity with stability theory, the boundary layer at stations up to about $\Phi = 80^\circ$ from the stagnation point and Reynolds numbers up to 2.5 million was stable to all small disturbances tested.

Microfilm \$2.75; Xerox \$3.60. 65 pages.

EFFECTS OF COOLING ON TRANSITION
IN THE BOUNDARY LAYER
ON A HEMISPHERE IN
SIMULATED HYPERSONIC FLOW

(Order No. Mic 61-2746)

Roger Dunlap, Ph.D.
University of Michigan, 1961

The purpose of this study was to investigate the effects of cooling on transition in the boundary layer on the nose of a 9-inch diameter hemisphere in simulated hypersonic flow, with the aim of gaining some knowledge of the circumstances under which boundary-layer cooling may promote a reduction in transition Reynolds number (transition reversal). The influences of cooling in increasing the stability to Tollmien-Schlichting type disturbances, in decreasing any stabilizing effects of convex curvature, and in increasing the magnitude of disturbances from fixed roughness elements, are discussed.

Simulation of the subsonic boundary layer on the hemisphere is accomplished using the "shroud" technique wherein the tunnel flow is subsonic upstream of the model. Boundary-layer cooling is effected by internally cooling the model with liquid nitrogen or dry ice and acetone.

A mathematical analysis, given in detail, is developed for predicting the shroud contour which will cause the hypersonic pressure distribution to prevail over the hemisphere up to the sonic point. The measured pressure distribution on the shrouded hemisphere is in good agreement with the Newtonian distribution specified in the analysis.

Experiments with small cooling rates, in which roughness elements were placed on the model, have qualitatively demonstrated the combined effects of cooling and roughness on boundary layer transition, as detected with a hot-wire anemometer. The results indicate that for a given cooling rate there are three distinct ranges of roughness heights insofar as their effect on transition is concerned; 1) the roughness may be small enough so that the boundary layer remains laminar either with or without the cooling, 2) the roughness may be of such a height that transition occurs only when the boundary layer is cooled, or 3) the roughness is large enough so that transition always occurs, independent of the amount of cooling.

To gain some knowledge of the effect of cooling on boundary layer stability, experiments were conducted in which the surface roughness was made as small as possible. These experiments involved, in addition to a highly polished surface, a low water vapor dewpoint, the avoidance of carbon dioxide condensation films, and special filtering of the airstream to remove most of the dust particles. When the roughness was small, little effect of cooling was found on transition, as detected with a pitot-pressure probe, at 40 and 45 degrees from the stagnation point. The values of local transition Reynolds numbers, based on distance from the stagnation point, and on momentum thickness, were, respectively, 5×10^6 to 6.3×10^6 and 600 to 700, for transition at 45° with wall to stagnation temperature ratios between 0.5 and 1.0. It is concluded that the stability of the subsonic boundary layer is not appreciably decreased in this range of temperature ratios.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

ENGINEERING, CHEMICAL

THE ELECTROLYSIS
OF SOME LIQUID ALLOYS

(Order No. Mic 61-2731)

John Cotton Angus, Ph.D.
University of Michigan, 1961

Molten alloys can be electrolyzed with direct current. This effect is commonly called electrodiffusion. Data from electrodiffusion experiments can be used to make inferences about the structure of the molten alloys. The previous experimental data are limited and, in general, of very limited accuracy. The purpose of this research is fourfold: 1) to devise a technique whereby electrical mobilities in molten alloys at high temperatures can be determined, 2) to obtain accurate data on several Bi alloys, 3) to investigate a correlation that states that the component with the smallest atomic weight migrates to the cathode, and 4) investigate the possibility of the existence of intermetallic compounds in liquid Na-Hg alloys by means of electrodiffusion experiments.

In collaboration with another worker a method was devised for measuring electrical mobilities. The technique was tested by reproducing the value of the mobility reported by another investigator for Na in dilute Na amalgams. The earlier value is $+ 1.19 \times 10^{-4} \text{ cm}^2/\text{sec volt}$; the value obtained in this investigation is $+ 1.23 \pm 0.23 \times 10^{-4} \text{ cm}^2/\text{sec volt}$ at the 95 percent confidence level. The technique was applied to the molten alloys Bi-Cu, Bi-Mg, Bi-Zr, and Bi-U. The following mobilities in $10^4 \times \text{cm}^2/\text{sec volt}$ were determined: Cu, at 0.5 wt. % and 500°C , $-1.85 \pm .25$; Mg, at 0.5 wt. % and 350°C , $-5.78 \pm .98$; Zr, at 0.0567 wt. % and 510°C , $+ 2.61 \pm 2.54$; U, at 0.0144-.310 wt. % and $445-500^\circ\text{C}$, $+ 2.57 \pm .67$. The mobilities are reported at the 95 percent confidence level. A positive mobility indicates the solute moves to the anode, a negative mobility means motion to the cathode. The sources of error were examined and suggestions given for increasing the accuracy of the technique.

Experiments on 0.5 wt. % Na amalgams show that the direction of transport of Na is to the anode when the temperature is below a certain value, and to the cathode when the temperature is above this value. The exact temperature of the reversal is uncertain since the experimental technique is not sufficiently sensitive to determine very low mobilities. It occurs in the range from 270 to 310°C . The reversal is interpreted as caused by the thermal decomposition of intermetallic compounds existing in the melt. This effect, which was predicted on the basis of the atomic mass correlation, has heretofore never been observed. It supplies additional evidence to that already available from thermodynamic, x-ray, and viscosity measurements for the existence of compounds in liquid alloys. In addition, a mechanism is presented as a possible explanation for the empirically observed correlation.

Microfilm \$2.75; Xerox \$6.20. 130 pages.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF VERTICAL BARRIERS IN LIQUID THERMAL DIFFUSION COLUMNS

(Order No. 61-2934)

Lyndon Dean Boyer, Ph.D.
The University of Oklahoma, 1961

Major Professor: Dr. John E. Powers

A thermogravitational thermal diffusion column is a device which effects partial separation of components in mixtures due to the combination of a temperature gradient and the resulting convection currents. Several investigators have reported that separations in thermogravitational columns increase with the introduction of vertical barriers. Almost no theory has been proposed by previous workers to explain the function of vertical barriers. Such theory has been developed in this work. Experimental investigations were carried out to test the new theory.

To explain increases in separation with barriers, the mathematical concept of an "ideal" vertical barrier has been proposed. The "ideal" vertical barrier is infinitely thin and allows free molecular diffusion, but allows no macroscopic bulk flow of material through the barrier. The choice of this model permitted the fundamental thermogravitational column theory of Furry, Jones, and Onsager to be modified to account for the introduction of any number of equally spaced "ideal" vertical barriers in a thermogravitational column. Real barriers allow macroscopic bulk flow of material to some extent, so the theory was further modified to account for bulk flow for the case of a single vertical barrier.

The theory developed predicts striking increases in separation with an "ideal" vertical barrier in a thermogravitational column at low product flow rates. At increasing flow rates the theoretical barrier advantage decreases; and in fact, the barrier is not advantageous at high throughputs. An important aspect of the theory developed is that it predicts the effect on separation caused by "ideal" barriers is identical to the effect attained by operating multiple columns without barriers in parallel with proportionally reduced temperature differences, plate spacings, and flow rates.

Experimental tests were carried out on various types of vertical barriers. Verification of the reported increases in separation was obtained using membrane-type (paper) vertical barriers. Perforated barriers of plastic film and metal foil were unsatisfactory.

Qualitative experimental confirmation of the new theoretical developments was found for both steady-state continuous-flow and transient batch thermogravitational columns using membrane-type vertical barriers. This type of barrier more nearly approaches the theoretical mathematical model than the others tested. Quantitative confirmation of barrier theory is not entirely satisfactory, because the basic thermogravitational column theory of Furry, Jones, and Onsager is not quantitative for liquids.

In addition to the work with barriers, the fundamental theory of Furry, Jones, and Onsager has again been qualitatively confirmed for steady-state continuous-flow and batch transient liquid thermogravitational columns without barriers. The thermal diffusion "constant" for the system ethyl alcohol-water was determined and is in agreement with other workers. Results using unequal product flow

rates are reported for steady-state center-fed continuous-flow thermogravitational columns.

Microfilm \$3.30; Xerox \$11.70. 256 pages.

DRYING OF SINGLE KERNELS AND DEEP BEDS OF SHELLLED CORN

(Order No. 61-2944)

David Henry Chittenden, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor O. A. Hougen

It is well known that cereal grains must be stored at low moisture contents, about 13% dry basis, to prevent spoilage. Since field drying depends on good weather, it is often necessary to harvest grain of high moisture content and dry it artificially.

In this study, the drying of stationary beds of shelled corn with through-circulation of heated air is considered. It is shown that the time dependent temperature and moisture content profiles for corn and air in the drying bed may be determined from knowledge of the drying rate of single kernels. Assuming that the corn kernel dries like a sphere of equivalent radius r_o , its drying rate is shown to be

$$\frac{3}{r_o} D(M) \left. \frac{\partial M}{\partial r} \right|_{r_o},$$

when internal resistance to moisture transfer is limiting. The effective moisture diffusivity D at the kernel surface depends on the temperature and moisture content at that point. The moisture gradient $(\partial M / \partial r)|_{r_o}$ depends on the history of the drying conditions for the kernel in question, not directly on the average kernel moisture content.

Experimental drying data were taken on single kernels of shelled corn from 20 to 60% initial moisture content which had been stored by freezing. High velocity air was blown past the kernels at constant temperature and relative humidity in the range 70 to 100 °F and 10 to 83% RH, respectively. It was found that the relationship of the average measured moisture content \bar{M} , and the drying time t , could be described within a standard error of estimate of 0.1% moisture content for most runs by the following equation:

$$\frac{\bar{M} - M_s}{M_o - M_s} = \frac{6}{\pi^2} \sum_{n=1}^{\infty} \frac{1}{n^2} \exp(-n^2 \pi^2 \bar{D} t / r_o^2) \quad (1)$$

where M_s = constant surface moisture content

M_o = uniform initial moisture content

\bar{D} = constant effective moisture diffusivity

r_o = radius of a sphere equivalent to the kernel

A modified least-squares method was used for determining the constants M_s , M_o , and \bar{D} for each run. The surface moisture content depended not only on air temperature and humidity, but also on the initial moisture content of the corn. This indicates that M_s is not an equilibrium value; it probably changes slowly during a drying run. The effective diffusivity \bar{D} did not depend on

relative humidity, however it was a function of temperature and initial corn moisture content. The dependence of diffusivity on moisture content cannot be neglected for the treatment of drying in fixed beds, but an average value was found to be suitable for drying single kernels.

Experiments were also made on deep beds of corn. Columns of corn 4" in diameter and 23" deep at uniform initial moisture contents from 16.15 to 32.10% dry basis, were dried for 3 to 8 hours with through-circulation of air at constant temperature and relative humidity in the range 100 to 140 °F and 2.3 to 22% RH, respectively. The axial corn moisture profile in the bed had a sigmoid form. This S-curve was steepened by increased air temperature, representing more severe drying conditions. It was flattened by increased air flow rate, in the range 70 to 160 lb of dry air/hr - ft² of cross section. It seems probable that the sigmoid moisture profile maintains its shape and moves through the drying bed at constant velocity. From this, it is reasonable that the data can be correlated in terms of $\beta = (x'/\tau G)$. The linear correlation obtained was

$$\beta = 14.80 + 0.2076 t_o - 1.4096 M_i + 1.2936 \tau - 0.1742 RH \quad (2)$$

where x' = distance in inches from the air inlet dried to 13% moisture content

τ = drying time, hours

t_o = air temperature, °F

M_i = dry basis initial moisture content

RH = relative humidity

G = air flow rate, lb dry air/hr ft²

Microfilm \$2.95; Xerox \$10.35. 226 pages.

ECONOMIC DESIGN OF A NITRIC OXIDE OXIDATION REACTOR

(Order No. 61-2945)

Chieh Chu, Ph.D.

The University of Wisconsin, 1961

Supervisor: Professor Olaf A. Hougen

Based on the reaction rate equation of Kircher and Hougen, the economic design of a catalytic reactor for the oxidation of nitric oxide to nitrogen dioxide using activated carbon was investigated. In the design, attention was given to the effects of mass and heat transfer across the gas film surrounding the catalyst particles and to changes in bulk stream pressure due to frictional pressure drop through the catalyst bed. Detailed calculations were made by means of an IBM 650 digital computer. For purposes of optimization, the evolutionary method of Box and Wilson was generally followed to establish the most favorable conditions of operation respecting percentage conversion, mass velocity, catalyst size and number of catalyst layers. In the preliminary investigation of the near-stationary region, a "radial line method" was developed and used instead of the method of steepest descent. The economy of

using multiple catalyst layers in parallel was also investigated.

The set of most favorable conditions was established for a plant capacity of 50 tons of NO feed per day:

1. Catalyst used, activated carbon
2. Nitric oxide in feed, 1.5%
3. Dew point of feed, -30°F
4. Temperature of feed, 30°C
5. Method of temperature control, adiabatic
6. Pressure, 1.6 psig at reactor exit
7. Percentage conversion, 98.6%
8. Mass velocity, 254 lb/(ft²)(hr)
9. Catalyst size, 0.384 in
10. Number of catalyst layers, 8
11. Catalyst loading, 83,400 lb
12. Thickness of catalyst bed, 2.64 ft
13. Diameter of reactor, 13.0 ft
14. Height of reactor, 48.0 ft
15. Pressure drop, 0.066 psi or 1.8 in of water

Microfilm \$2.75; Xerox \$6.80. 143 pages.

THE THREE-PHASE HYDROLYSIS OF ISOAMYL ACETATE IN A STIRRED REACTOR

(Order No. 61-2950)

Alfred J. Engel, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor O. A. Hougen

The hydrolysis of slightly water soluble isoamyl acetate was carried out in the presence of a large excess of water and an acidic ion-exchange resin catalyst in a stirred reactor in order to investigate the reaction and mass-transfer mechanisms and to study the possible use of such a reacting system for testing the effectiveness of a stirred reactor.

The variables and the ranges over which they were studied were:

1. Stirring speed: 105 to 2900 rpm.
2. Temperature: 80 to 160°F
3. Catalyst particle diameter: 0.0256 to 0.4146 mm.

The "fully baffled" reactor was operated at half-full conditions and only yielded meaningful results at stirring speeds up to 600 rpm; at higher speeds, an excessive amount of splashing occurred in the reactor which actually decreased the relative motion between the liquid and the solid catalyst and thereby made mass transfer less effective than at lower speeds.

The results of this study indicate that the major

resistance to the over-all process is offered by the diffusion of the ester into the interior of the catalyst. However, for catalysts of very small particle size, diffusion of the ester through the liquid immediately surrounding the catalyst also causes a significant resistance to mass transfer, and this resistance is strongly affected by the degree of agitation in the reactor.

If R_s , R_r , and R_o represent the dimensionless mass transfer resistances outside the catalyst, inside the catalyst, and over-all, respectively, then:

$$R_o = R_s + R_r$$

or
$$\frac{1}{N_{Nu}} = B(\rho_c/m)(N_{Re})^{-0.5}(N_{Sc})^{1.3} + 1.37 \times 10^{-13}(D/D_c)^{-0.64} e^{12,400/RT}$$

where

- N_{Nu} = the Nusselt number for mass transfer
- N_{Re} = the Reynolds number for a stirred reactor
- N_{Sc} = the Schmidt number
- ρ_c = the catalyst density
- m = catalyst loading
- D = impeller diameter
- D_c = catalyst particle diameter
- B = $f(D_c)$ having a significant value only for very small particles.

This correlation fits the experimental data with an average deviation of about 16%.

In order to obtain a measure of the efficacy of the stirred system, a "contactor efficiency" was calculated. For an ideally stirred system, the contactor efficiency would be unity. In this study, it ranges from 0.11 at a stirring speed of 175 rpm, the lowest speed giving total catalyst suspension, to 0.25 at 580 rpm, the speed at which maximum efficiency occurred. These relatively low efficiency values are caused by the fact that the relative velocities between the small catalyst particles and the liquid were limited by the speed at which the reactor could be stirred. Excessive splashing at stirring speeds exceeding 580 rpm actually decreased relative velocities, so as to decrease the contactor efficiency.

Since the correlation presented here is based on dimensionless groups it should be applicable for scaleup of reactor dimensions within the ranges of the variables studied. Some additional work may be necessary before the reacting system will become useful for measuring contactor efficiencies in various stirred reactors.

Microfilm \$2.75; Xerox \$7.40. 160 pages.

SIMULTANEOUS HEAT AND MASS TRANSFER IN A PACKED LIQUID-LIQUID EXTRACTION COLUMN

(Order No. Mic 61-1090)

Deran Hanesian, Ph.D.
Cornell University, 1961

Simultaneous heat and mass transfer rates are measured in a packed liquid-liquid extraction column. The column is 40.5 mm I.D. and is packed to a height of one foot with 1/4-inch Raschig rings. The streams pass countercurrently through the column and transfer of heat and mass is from the continuous aqueous phase to the dispersed organic phase. The three systems which are investigated are acetic acid-benzene-water, benzoic acid-benzene-water, and iodine-n-heptane-0.25N potassium iodide solution.

Temperature differences of about 0.5°C are maintained between the phases and the measurements are made with paired thermistors.

Heat balances appear to be affected by the mass transfer. Where the quantity of mass transferred is small, heat balances are within 1.5 per cent. For higher rates of material transfer, the heat balance differs by about 3 to 7 per cent. It is shown that the heat balance can be reduced to within 1 per cent if higher quantities of heat are transferred.

Empirical regression equations are given for each system. The individual resistances are determined from the over-all heights of a transfer unit and the extraction factors. Holdup data are reported and the increase in holdup with flow rates appears to be the major cause in the rise of the over-all volumetric mass and heat transfer coefficients. Anomalous results in the iodine system cause a negative continuous film resistance.

The mass and heat transfer analogy is presented between the individual film resistances and the molecular properties. The equations are of the form

$$\frac{(HTU_d)_h}{(HTU_d)_m} = \left[\frac{D_d}{\alpha_d} \right]^n$$

where

$(HTU_d)_h$ = height of a transfer unit for dispersed phase for heat transfer, ft;

$(HTU_d)_m$ = height of a transfer unit for dispersed phase for mass transfer, ft;

D_d = molecular diffusivity for mass transfer, ft^2/hr ;

α_d = molecular diffusivity for heat transfer, ft^2/hr .

The exponent, n , is near 2/3 for the two benzene studies and Colburn's analogy holds for these systems. However, n is about 0.5 for the iodine-n-heptane system and the analogy is better represented by the penetration theory.

A tentative method of predicting individual resistances and relative resistances from basic physical properties is presented. The method predicts the resistances for the published data on the diethylamine-toluene-water system with 1/4-inch packing. An attempt is made to predict the acetic acid-methylisobutyl ketone-water system for 1/2-inch packing. The prediction is within 25 per cent.

Microfilm \$3.80; Xerox \$13.30. 295 pages.

**FLUID FLOW AND HEAT TRANSFER
IN STRATIFIED SYSTEMS**

(Order No. Mic 61-2763)

Marvin LaVerne Katz, Ph.D.
University of Michigan, 1961

The flow of fluids in stratified porous systems and the analogous problem of heat conduction in stratified solids have been investigated both from an experimental and a purely mathematical standpoint. The individual layers of the stratified systems studied were assumed to be both homogeneous and isotropic at all interior points. The models used allowed for complete communication between layers, so that interlayer fluid flow occurred in the unsteady state.

A total of five heat transfer models were used to obtain experimental data. The primary purpose of obtaining the data was to verify the validity of the mathematical solutions obtained. The two two-layer models which were investigated were fabricated from a clad steel plate in which one quarter inch of type 316L stainless steel was uniformly bonded to one quarter inch of mild steel.

The investigation of the problems from a mathematical standpoint was completely independent of the experimental investigation. Solutions were obtained directly from the partial differential equations governing flow in the stratified systems, using the technique of separation of variables.

In the process of developing the mathematical theory of stratified systems, considerable work was done on single-layer homogeneous systems. Tables in the literature for dimensionless flux have been extended. Tables of dimensionless pressure (or temperature) distribution are also presented.

The mathematical solutions for multi-layer systems occur in the form of double infinite series. Tables of results for various values of the physical parameters have been computed and are presented in the Appendices. These tables permit the calculation of pressure (or temperature) distribution and various fluxes at the producing face in two-layer systems.

The IBM 704 digital computer was used to calculate eigenvalues and sum the series solutions obtained. Tables of eigenvalues are presented in the Appendices.

The majority of the mathematical work on stratified systems was concerned with two-layer systems, both linear and radial. The means of extending the two-layer solutions to the case of general multi-layer systems is presented. Tables of results were not computed for more than two layers.

The application of the solutions obtained to problems of fluid flow in petroleum reservoirs is discussed. Seven example problems are presented to illustrate the use of the tables of results in such problems. Approximation methods are discussed for representing the behavior of multi-layer systems by a single homogeneous layer having mean physical properties.

Microfilm \$4.65; Xerox \$16.45. 364 pages.

**A STUDY OF THE CHLORINATION OF BENZENE
USING Co⁶⁰ GAMMA RADIATION
IN A FLOW SYSTEM**

(Order No. Mic 61-2150)

John Murray McCabe, Ph.D.
University of Minnesota, 1961

Reactions in which a complex mechanism is followed (those which contain consecutive or competing steps) are known to follow different paths in batch and in flow systems.

In this investigation the kinetics of radiation initiated chlorination of benzene were studied in a continuous stirred tank reactor. This reaction follows a long-chain mechanism.

The single-phase system of benzene saturated with chlorine was fed to a stirred tank reactor irradiated with a Co⁶⁰ gamma source. The product consisted primarily of the stereo-isomers of hexachlorocyclohexane.

The effects of chlorine concentration and of radiation intensity were studied. The effect of temperature was noted, but could not be quantitatively determined because of the effect of an inhibitor which was apparently present. Possible mechanisms for the effect of this inhibitor (which gave a marked induction period) were presented.

Techniques were developed to determine the free chlorine concentration in the benzene solution, and to determine the isomeric content of the hexachlorocyclohexane.

The data taken could be fitted by an over-all rate equation in which the rate of reaction is directly proportional to the concentration of the chlorine and proportional to the square root of the radiation intensity.

Microfilm \$2.75; Xerox \$6.20. 128 pages.

**KINETICS OF THE CATALYTIC HYDROGENATION
OF PROPYLENE**

(Order No. 61-2976)

Gary Boyd Rogers, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor O. A. Hougen

A study of the initial rate of the catalytic hydrogenation of propylene has been made. The catalyst used for this study was a reforming catalyst consisting of 0.6% by weight of platinum dispersed on a high area alumina base. Five small beds of this catalyst were spaced at intervals along the 1/4" I.D. tube serving as the reactor, the space between the beds serving to intercool the reactant gas. Due to the small catalyst particles used, and the large gas velocity maintained through the reactor, heat and mass transfer resistances both inside and outside the catalyst particles were eliminated. The product gas was analyzed for propane using a gas chromatograph. This instrument was sufficiently sensitive to allow accurate analysis of gases containing approximately 0.1 mole % propane.

The reaction was found to be very rapid, and possessed a large temperature coefficient, such that temperatures above 35 °C could not be easily studied. Over the range of conditions covered, the reaction rate was found to increase

as the partial pressure of propylene decreased, although the reaction rate was practically zero order with respect to the olefin at low temperatures. The ranges of experimental conditions covered are as follows:

Temperature:	1.4 °C to 34.3 °C
Total pressure:	0.25 atm. (using helium dilution) to 4.0 atm.
Propylene concentration in feed gas:	5 to 45 mole %

The catalyst activity fluctuated from batch to batch, and also during a day's operation. In order to correct for this variation, standard runs were performed at intervals, and all runs were corrected to the same activity level. The runs taken using helium dilution were found to scatter badly, indicating that the helium, or some minor impurity in the helium, affected the catalyst activity in a fashion that could not be accounted for by the usual correction procedure. These runs were not used for correlation.

It was found that none of the models proposed in the literature to describe olefin hydrogenation would correlate the data. A new model was developed which describes the rate when the rate-controlling step is the surface reaction between molecularly adsorbed hydrogen and adsorbed olefin, both competing for the same sites. This model differs from the Hougen-Watson model in assuming that the maximum possible coverage of the surface by the olefin, which requires two adjacent sites for adsorption, is less than one. The equation used for correlation could not be linearized with respect to the constants, so a non-linear least squares program written for the IBM 704 computer was used for correlation.

The equation used, and the constants obtained, are:

$$r = \frac{(1 - F_U) \alpha K_H K_U p_{PH} p_U}{(1 + K_H p_H)(1 + K_H p_H + K_U p_U)} \left(1 - \frac{(1 - F_U)(K_U p_U)}{1 + K_H p_H + K_U p_U} \right)$$

where

$$\ln \alpha = -\frac{14,950}{RT} + \frac{52.93}{R}$$

$$\ln K_H = \frac{4214}{RT} - \frac{16.15}{R} \quad (T [=] ^\circ K)$$

$$\ln K_U = \frac{9190}{RT} - \frac{23.74}{R}$$

$$F_U = 0.1441 / (1 + 2.37 \times 10^{-n} e^{\frac{-16,330}{RT}})$$

Here, r = reaction rate, moles product/lb-hr

α = rate constant

K_H = adsorption equilibrium constant for hydrogen

K_U = adsorption equilibrium constant for propylene

p_H = hydrogen partial pressure, atm.

p_U = propylene partial pressure, atm.

F_U = fraction of the surface unavailable for propylene adsorption

All constants have reasonable temperature trends, and as expected, K_U was much larger than K_H . The final model reproduced the runs used for correlation with an average deviation of about 3.2%.

Microfilm \$2.75; Xerox \$7.80. 170 pages.

GAS ABSORPTION RATES IN A MODIFIED WETTED WALL COLUMN

(Order No. Mic 60-4696)

Roy Ellis Selby, Sc.D.
Washington University, 1959

Chairman: Professor W. P. Armstrong

Absorption of five gases, carbon dioxide, oxygen, nitrogen, helium, and Freon 12 (CCl_2F_2) was measured in a one inch diameter, vertical glass wetted wall column of constant length.

Four variables were measured and controlled.

- 1) Three nominal gage pressures were used, 2.0, 6.0, and 10.0 psig.
- 2) Three column temperatures were used at each pressure, 25 °C, 35 °C, and 45 °C.
- 3) Six water flow rates were used, three in each of the regions of laminar and turbulent flow at each temperature and pressure for each gas.
($N_{Re} = 500$ to 5100.)
- 4) The gas flow rate which was in equilibrium with the water flow rate at each previously described set of conditions was measured.

The data were correlated by two approaches arising from dimensional analysis, one acknowledging only molecular diffusion, and the second both molecular and eddy diffusion. The second involved the use of a reference equation to obtain values of the apparent eddy diffusivity. This equation was subsequently eliminated from the correlation by using a relationship between eddy diffusivity, molecular diffusivity, and Reynolds number.

The reproducibility of the data was fair, the average deviations being less than $\pm 5\%$. The apparent eddy diffusivities varied from 1 to 3 times the molecular diffusivities at $N_{Re} = 500$ to 10 to 20 times at $N_{Re} = 5000$, and were functions of the particular gas.

A possible approach for handling surface effects has been developed and presented.

Microfilm \$2.75; Xerox \$5.60. 113 pages.

THE MEASUREMENT OF IMPACT STRESSES IN BRITTLE MATERIALS

(Order No. Mic 61-2849)

William Beattie Shook, Ph.D.
The Ohio State University, 1961

The measurement of impact failure stresses in ceramic materials has been attempted by several investigators. Calculations are based on an energy statement equating the work done by the hammer to the bending energy stored in the specimen at failure. The important assumptions inherent in such calculations are that (1) the deflection curve is the same in impact as it is in the static case, so that the energy distribution is known; (2) the impacting weight and the beam under test attain a state of rest at the instant of failure; (3) the energy measured represents only that necessary to break the specimen; (4) the effect of shear may be neglected; and (5) the inertia of the bar is adequately

accounted for by a correction factor based on assumption 1.

In view of the above limitations of energy techniques, the more direct measurement of force and time was considered.

A Fourier series solution is developed for the case of a simply supported beam struck at the center of the span, with the assumption that a bending failure results. The equation for maximum stress at failure is as follows:

$$\sigma_{\max} = \frac{h k L}{I} \left(-\sqrt{e} F(\tau, \nu, R, L) + \frac{t}{8} \right)$$

where

σ_{\max} = outer fiber stress

h = depth in the direction of impact

k = slope of the force-time curve

L = span

I = moment of inertia of the cross section about the neutral axis

e = density/Elasticity

t = time to failure

τ = t/\sqrt{e}

ν = Poisson's ratio

R = radius of gyration of the cross section

Variations of the time-dependent function are examined for a wide range of ν , R , and L . The results permit a graphical solution for all specimen sizes of interest in impact measurements.

The theory is applied to force-time measurements on a low-temperature vitreous body. The impact failure stresses are found to be essentially the same as the modulus of rupture, under the specific conditions of uniform rate of load application. However, with hard striking faces at normal testing velocities, it is found that the load is applied in one or more impulses. Under these conditions it is possible to cause failure with the application of only 60 per cent of the modulus of rupture.

The results of low-velocity measurements on a variety of commercial whiteware bodies are shown.

Microfilm \$2.75; Xerox \$5.20. 102 pages.

HEAT AND MOMENTUM TRANSFER IN LAMINAR FLOW: HELIUM, INITIALLY AT PLASMA TEMPERATURES.

(Order No. Mic 61-2856)

Richard Jay Wetherhorn, Ph.D.
The Ohio State University, 1961

In using plasma generators for chemical synthesis, it is necessary to cool gases rapidly. One method of rapidly cooling a gas is to direct its flow through a small diameter heat exchange system. The design of such a system requires predicting the rates of heat and momentum transfer at temperature differences in the range of $10,000^{\circ}\text{R}$.

Data for these predictions have not been available. The present investigation seeks to provide such data.

A novel plasma generator was built which was capable of arc input energies in excess of 40,000 Btu/hr. With helium as the working gas, mass flow rates were varied from 0.213 to 1.263 lbm/hr. Current levels were varied up to 500 amperes. Plasma temperatures in the anode section exceeded $50,000^{\circ}\text{R}$. Exit plasma temperatures varied up to $15,000^{\circ}\text{R}$.

The exit plasma or gas was cooled in a three-unit, water-cooled heat exchange system which provided heat transfer and pressure loss data at L/D values of 11, 19, and 27. Average gas temperatures decreased by as much as $13,000^{\circ}\text{R}$ through this 3.37-inch test section. Bulk temperatures varied from 2000° to $11,000^{\circ}\text{R}$. Heat transfer rates were as high as $2,500,000 \text{ Btu/hr-ft}^2$. Average residence time of the gas in the test section was as low as 0.1 millisecond. Mach numbers were generally under 0.4.

The heat transfer data correlated favorably according to the Graetz solution for laminar flow. Heat transfer coefficients varied from 50 to 300 $\text{Btu/hr-ft}^2 \cdot ^{\circ}\text{R}$. Corresponding Nusselt numbers varied from 1 to 8. Graetz numbers varied from 3 to 25.

The momentum transfer data correlated to within 50 percent of the isothermal relationship, $f = 16/\text{Re}$. Friction factors varied from 0.01 to 0.1, with Reynolds numbers varying from 100 to 700. An L/D effect was apparent.

For the conditions of this investigation, a Reynolds type analogy for laminar flow holds well but is improved if a temperature correction term is included:

$$\frac{f_a}{2} = \frac{2h_a}{\rho v c_p} \left(1 - \frac{T_w}{T_b} \right).$$

A comparison of this analogy with a heat and momentum transfer analogy, developed from molecular transport theory,

$$\frac{f_a}{2} = \frac{h_a}{\rho v c_p} \left(\frac{\gamma_h}{\gamma_m} \text{ Pr} \right),$$

indicates that for laminar flow and a Prandtl number of one, the temperature profile correction is $(1 - \frac{T_w}{T_b})$ and the velocity profile correction is one-half.

Based on the more stringent conditions that the pressure gradient be zero and the outlet gas temperature be negligible compared with the inlet gas temperature, further relationships were developed:

$$\frac{f_a}{2} = \frac{2h_a}{\alpha \rho v c_p}$$

$$\frac{f_a}{2} = \frac{1}{\alpha(L/D)}$$

$$h_a = \frac{\rho v c_p}{2(L/D)}$$

The values predicted by these relationships were approached in this investigation. They account for the observed L/D effect and provide a simple means of approximating heat transfer coefficients and friction factors for these conditions.

Microfilm \$2.75; Xerox \$7.60. 162 pages.

**DESIGN AND MASS TRANSFER STUDY
FOR NEW MULTISTAGE
FLUIDIZATION REACTOR**

(Order No. Mic 61-2410)

Kenneth Donald Williamson, Jr., Ph.D.
The Pennsylvania State University, 1961

Multistage fluidization reactors in use today are generally equipped with downcomers to permit the movement of solids from stage to stage. However, this method of achieving downward transport of solids sometimes results in unstable column operation. To overcome this problem a method was developed by this author which eliminated downcomers and achieved downward transport of solids by utilizing vibration to "shake-down" the fluidized material through a plate consisting of large, non-fluidized, spherical beads and a support screen. It was the purpose of this work to improve the preliminary plate design, build a three-stage six-inch diameter column and to obtain and correlate design and mass-transfer data using the new equipment.

For the design study the glass-bead air system was used. The data were evaluated on the basis of the effect that changes in the variables had upon the solids throughput rate. This rate was determined as a function of (1) vibrator size and vibrational frequency, (2) feed particle size, (3) plate resistance, (4) superficial air velocity and (5) fluidized bed-depth.

Two improvements were made on the preliminary plate design. The first was the incorporation of a cover screen as part of each plate. This in effect "sandwiched" the large non-fluidized beads and resulted in greatly improved operational stability. The second improvement was the use of internal vibration. This advance permitted control of the fluidized solids bed depth on an individual stage basis.

All of the design data were correlated into a set of five equations. These equations account for variations in feed particle density, shape and size; column cross sectional area; density and superficial velocity of the fluidizing gas; and the amount and size of the non-fluidized beads on the distributor plate. From the equations it is possible to calculate the amount and size of non-fluidized beads that are necessary to achieve a given throughput rate of any material under any operating conditions. The correlation was tested by making runs using non-spherical alumina and silica gel feeds.

For the mass-transfer study, the silica-gel water-vapor adsorption system was chosen because it lends itself readily to the fluidization technique and presents no difficult analytical problems. The equilibrium relationship for the system was determined for temperatures from 20 to 40°C and pressures from atmospheric to 20 psia. The data were then used to evaluate the Murphree vapor efficiency for the adsorption of water vapor from air by silica gel in the six-inch diameter column. From the efficiency a modified mass-transfer coefficient was calculated. The efficiencies were evaluated over a range of bed depths and superficial air velocities.

For all bed depths investigated (3/4 in. to 8 in.) and all but the highest air velocity, the Murphree vapor efficiency was found to be approximately 100%. At an air velocity of 0.98 ft/sec the efficiency dropped to 96.5% which corresponds to a modified mass-transfer coefficient of 35.4

lb/sec-ft³-lb/ft³. The high efficiencies can not be attributed to the equipment design but rather to the fact that the gel particles were small and would be efficient in any type of equipment under the operating conditions used in this study. Microfilm \$2.75; Xerox \$7.60. 161 pages.

ENGINEERING, CIVIL

HYDRATION TEMPERATURES IN CONCRETE

(Order No. Mic 61-1053)

Clement L. Tai, Ph.D.
Polytechnic Institute of Brooklyn, 1961

Adviser: J. R. M. Radok

This paper presents the outcome of a theoretical investigation of the one-dimensional flow of hydration heat in continuously growing concrete and the development of a numerical method for the utilization of the one-dimensional solutions in two-dimensional situations.

An analytical solution of the problem of linear flow of hydration heat in a growing semi-infinite concrete region or a column insulated at its lateral surface is obtained after a transformation of the coordinates which effectively fixes the boundary. A similar treatment of the problem of a growing concrete column with radiation at its lateral surface is presented. In each case numerical results have been computed and plotted in a series of temperature rise curves for both low heat and ordinary cement concrete with various pouring rates.

A numerical method for the use of the one-dimensional results in the two-dimensional problem of a growing concrete dam has been developed. An illustrative example has been worked out to demonstrate the use of the method in practical applications.

The obtained linear solutions are readily programmed for high speed computers and the corresponding results of temperature distribution, which in the past have been found by tedious graphical integrations or successive numerical approximations, can be obtained within minutes. The simplicity of the developed two-dimensional method, which is convenient for practical applications, might well balance the degree of its approximation in comparison with the much more complicated difference method developed in Czechoslovakia.

Microfilm \$2.75; Xerox \$4.40. 84 pages.

ENGINEERING, ELECTRICAL

ON SIGN PATTERNS OF BRANCH MATRICES
AND R-GRAPH REALIZATION

(Order No. Mic 61-2680)

David Paul Brown, Ph.D.
Michigan State University, 1961

Major Professor: M. B. Reed

This thesis deals with properties of sign patterns of the entries in the coefficient matrix of the branch (node-pair) equations, branch matrix, for any graph, and the realization of a given matrix as the branch matrix of an R-graph.

In the second section, properties of sign patterns are classified as to those fixed by: (1) element orientations per se; (2) element orientations determined by their being contained in subgraphs. The main result in (1) is that if the branch orientation of a tree of a part is changed, then there is a row and column sign change of the entries in the corresponding branch matrix for diagonal element matrix, and conversely. This result is based on the relationship between the s-orientation of any two f-segs and the s-orientations of the corresponding common elements. In (2), a subgraph consisting of any two branches, b_i and b_j , contained in a path-in-tree is considered. The fact that the p- and e-orientation of b_i and b_j coincide is shown to imply that the s-orientation of the elements common to the f-segs corresponding to b_i and b_j are the same, and conversely. A set of pairs of branches, each pair having coincident p- and e-orientations is shown to imply that all branches of the set are contained in a path-in-tree with coincident p- and e-orientations. The situation when the p- and e-orientations do not coincide is also considered. The specific character of a subgraph of the tree corresponding to a branch matrix containing a principal submatrix with all positive or all negative entries is then obtained. The complete tree form is determined for the case of all positive or all negative entries in the branch matrix.

The necessary and sufficient conditions on a given matrix such that it is realizable as an R-graph consisting of the union of a complete graph and Lagrangian tree are determined in the fourth section. Formulas for corresponding element values and a process to determine the orientation of the tree are also given. It is found that the conditions for realization are fixed by the tree form associated with the branch matrix. Using the tree transformation matrix of the third section, necessary and sufficient conditions for realization are determined for an arbitrary tree. The detailed form of the conditions for realization are given for a tree in the form of a path. For the case of a five vertex complete graph, the conditions fixed by the three tree forms are given in detail.

Microfilm \$2.75; Xerox \$3.00. 45 pages.

NEURISTOR STUDIES

(Order No. Mic 61-1027)

Hewitt David Crane, Ph.D.
Stanford University, 1960

NEURISTOR is the name assigned to a novel class of hypothesized devices, whose conception was stimulated by consideration of the following question. Is it possible to build an electronic computer in an environment in which good conductors, or "wires", are not available for carrying signals? The question itself was stimulated by consideration of "miniaturization" techniques for electronic systems, in which small-scale "wires" may indeed be very tiny and transmission losses rather high.

That an arbitrary computer system can actually be realized in such an environment is indicated in this thesis. A recipe for success is to consider active, rather than passive, channels for the transmission of signals. Of prime importance, however, is the fact that such channels provide far greater logical power than would be exhibited in their simple role as "active wire" for the interconnection of conventional circuit elements. Actually, as indicated in detail in the thesis, such active channels alone provide full logic facility for system realization, so that arbitrarily complex computer systems may be realized with networks of suitable interconnected "devices" or channels of this type. No other components are required. Active channels suitable for use in this role are called neuristors.

A neuristor is defined as a device having the form of a one-dimensional channel along which signals may flow, the signals taking the form of propagating discharges having the following properties:

1. Threshold stimulability
2. Uniform velocity of propagation
3. Attenuationless propagation
4. Refractory period following the passage of a discharge, after which the neuristor can again support a discharge.

It is of interest to note that certain existing "devices" must be considered members of this class; these are the common chemical fuse, and the axon process (nerve fiber) of a neuron. A fuse, which may be characterized as a one-dimensional channel of "resting" (chemical) energy, satisfies the first three listed properties. Thus, once triggered, the character of the burning zone is essentially uniform (as the discharge moves uniformly along the line) and may travel an arbitrarily long distance without attenuation. Being a "one-time" device, however, a fuse is not of especial interest as a computing device. However, the axon process of a neuron exhibits basically the same properties as exhibited by a fuse, except that the axon line is "self-healing" after each discharge, and so can be used an arbitrary number of times. The refractory period is a measure of the time of healing, and in this sense, a fuse may be said to have an infinite refractory period.

Thus, a neuron, which operates on ionic principles, is an example of neuristor realization in a liquid environment. In the thesis, it is demonstrated that such properties can be realized in homogeneously distributed electronic structures as well.

The primary objective of the thesis is an investigation of the logical power of and the development of specific techniques of logic realization using neuristors. To develop neuristor networks it is necessary to specify the allowed modes of interconnection of such devices. It is indicated that there are basically two types of junctions—namely a T junction and an S junction. All network synthesis is then a "game" on these two (junction) "symbols". The game and logical possibilities are studied in considerable detail. It is demonstrated that not only may all of the conventional logic network properties be realized with neuristors, but also some properties not having simple direct analogs. Two properties in particular, worth noting, are (1) the ability to realize any nonplanar logic network on a two-dimensional physical structure, and (2) the ability to obtain controllable probabilistic gate structures with exactly the same basic neuristor device.

Microfilm \$2.75; Xerox \$9.25. 204 pages.

**LONGITUDINAL PUMPING ON
FERROMAGNETIC MATERIALS
WITH APPLICATION TO A NEW TYPE OF
MICROWAVE PARAMETRIC AMPLIFIER**

(Order No. Mic 61-2744)

Richard Todd Denton, Ph.D.
University of Michigan, 1961

The purpose of this study is to analyze the effects of longitudinal parametric pumping (r-f magnetic field parallel to the d-c magnetic field) on the modes of ferromagnetic materials, and to utilize the results of this analysis in the development of a new type of ferromagnetic microwave amplifier. Application of the longitudinally pumped long-wavelength modes results in a microwave ferromagnetic amplifier which operates continuously and requires fractional watts of pump power.

The analysis of the effect of longitudinal pumping on modes of ferromagnetic materials is broken into two parts. In one part the effect on very short-wavelength modes is analyzed, and in the other the effect on very long-wavelength modes is considered. It is shown that single short-wavelength modes at half the pumping frequency are parametrically pumped to oscillation and an expression is derived for the required pumping field. In the analysis of the effect of longitudinal pumping on the long-wavelength modes it is shown for the first time that pairs of these modes can be parametrically pumped to oscillation. An expression is derived for the r-f field required to pump the pairs of modes to oscillation which leads to selection rules for determining which pairs of modes can be pumped. The selection rules are based on symmetry properties of the modes.

A microwave ferromagnetic amplifier which was conceived and developed by the author is then described. This amplifier is a parametric amplifier which utilizes pairs of the longitudinally pumped long-wavelength modes. Theoretical expressions for the gain and bandwidth of the amplifier are derived from the driven equations of motion for the modes and used to derive a figure of merit for the amplifier. Practical considerations involved in the amplifier development are presented and the deleterious ef-

fects of the longitudinally pumped short-wavelength modes are discussed. Finally, experimental results on the gain, bandwidth, and noise figure of two models of the amplifier are presented. One model gave a gain-bandwidth product of 1 megacycle at a center frequency of 4560 mcps with a noise figure of 13.5 db for 400 milliwatts of pump power at 9180 mcps. The other model gave a 500 Kcps gain-bandwidth product at a center frequency of 5575 mcps with a noise figure of 13.1 db for 500 milliwatts of pump power at 11,063 mcps.

The results of this study show that a microwave ferromagnetic amplifier can be built which requires small pump powers. The initial results are a decided improvement over previous ferromagnetic amplifiers and it is possible that with cooling and other improvements this amplifier can match or better the characteristics of other parametric amplifiers.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

**NONLINEAR ELECTRON-WAVE INTERACTION
IN CROSSED ELECTRIC AND
MAGNETIC FIELDS**

(Order No. Mic 61-2750)

Om Parkash Gandhi, Sc.D.
University of Michigan, 1961

A general two dimensional large-signal theory is developed for electron-wave interaction in crossed d-c electric and magnetic fields. The six nonlinear integro-differential equations are adapted to study thin- and thick-stream forward- and backward-wave interactions and interactions with multiple streams in crossed fields.

The large-signal equations are derived by the self-consistent field method with the space-charge fields evaluated by means of a three-dimensional Green's function in an equivalent rectangular tube, the walls of which coincide with the sole, the anode plane and the two sole end hats. The error involved in the space-charge field expressions due to replacing the slow-wave structure by a smooth conducting electrode is shown to be negligible. The space-charge fields are simplified to the two-dimensional case in terms of a weighting function dependent upon the ratio of the beam width in the direction of the magnetic field to the spacing between the end hats.

The electron stream at the input to the device is divided into a number of layers, each effectively representing approximately 4-5 percent of the interaction region. The large-signal equations are solved on a high-speed digital computer for the electron trajectories, the r-f phase lead and gain characteristics by following the individual charge elements into which the stream is divided.

The effects of magnetic field, space-charge forces, injection velocity parameter and stream thickness on the interaction are studied for both Brillouin and nonslipping laminar streams. The retention of acceleration terms in the equations of motion is necessary to account for the excitation of cyclotron waves, which are important for cases where $\omega_c/\omega D < 5$. The improvement in phase focusing with the inclusion of space-charge forces results in an improvement of the interaction. Gain characteristics for nonlaminar streams are presented for varying degrees

of nonlaminarity at the input. The growth factor for thick Brillouin streams is somewhat reduced from that for thin beams due to a wide velocity variation which proved a hindrance to phase focusing.

The start-oscillation length of a backward-wave oscillator is determined for varying r-f power levels and is found to be shortest for a power level such that there is very little electron collection on the r-f structure.

In the double-stream crossed-field interaction, the increased growth parameter is due to the coulomb force between bunches in the two streams, causing the upper bunch to move closer to the circuit and thus enhancing the growth mechanism. The small-signal equations developed for the positive-sole crossed-field interaction indicate the excitation of beating velocity waves on the electron stream under such an interaction. The "complementary behavior" of positive-sole crossed-field interaction with normal (negative-sole) interaction is established on the basis of small-signal equations and some of the results are compared with those obtained from the large-signal equations adapted to the positive-sole case.

On the basis of a small-signal premodulation analysis it is found that the drift regions are fairly broadband in phase characteristics and the phase-length characteristics are obtained for maximum growing-wave excitation at the output of these regions.

Microfilm \$3.65; Xerox \$12.85. 282 pages.

ANALYSIS OF THE INTERACTION BETWEEN A MEASURING PROBE AND A REFLECTOR

(Order No. Mic 61-2429)

Hwei-Piao Hsu, Ph.D.
Case Institute of Technology, 1961

The effect of the interaction between the reflector edge, and/or the reflector, and the probe antenna on the measured signal was investigated. The analysis was based on the reciprocity theorem for two antennas, with the use of the solutions mentioned in the following. The diffraction of a dipole field by a conducting half plane in a parallel plate region was studied by the method based on the Wiener-Hopf technique. A solution to the above problem that is suitable for the present purpose was obtained. The induced current on the surface of a prolate spheroid due to a uniform applied field was investigated, the purpose being to obtain an estimate of the current distribution on a probe antenna. The problem of a prolate spheroid was treated as an approximation to a cylindrical probe.

A technique to estimate the relative error between the observed signal and the actual field in the absence of the probe, as a function of the probe parameter, was developed and some numerical examples evaluated.

Microfilm \$2.75; Xerox \$5.20. 105 pages.

OPTIMAL DESIGN OF MULTI-STAGE TUNED-TRANSISTOR AMPLIFIERS CONSIDERING GAIN, STABILITY AND SENSITIVITY.

(Order No. Mic 61-1025)

Bhagawandas Pannalal Lathi, Ph.D.
Stanford University, 1961

This report is concerned principally with developing simplified and convenient design procedures for single-stage and multi-stage amplifiers using either inherently stable or potentially unstable devices. The amplifiers have been considered from three important aspects, viz., stability, sensitivity and gain. Although the emphasis of this report is on amplifiers using transistors, the results are presented in a form applicable to any linear active device.

Various workers have established the stability criterion for single-stage tuned amplifiers. In the case of multi-stage amplifiers the terminations for each stage (except the first and the last stage) are provided by the output immittance of the previous stage and the input immittance of the following stage. These immittances vary with frequency and with the adjustments of the tuned circuits associated with the various stages of the amplifier. Thus the stability criterion for a stage operating in a multi-stage amplifier is much more complicated than the stability criterion for a single-stage amplifier terminated by fixed immittances.

The previous solutions of the problem of multi-stage amplifiers are characterized by the fact that the stability of the amplifier only at particular terminations is considered. It can be easily shown, however, that such an amplifier which is stable at particular terminations may become unstable by adjusting the tuned circuits associated with various stages. This is because changes in adjustment of any tuned circuit associated with a particular stage cause the changes in the terminations and the stability factors of all the other stages. In this report the design procedure is so developed that under all possible alignment conditions of the tuned circuits of the amplifier, the stability factor for each stage is maintained above a certain prescribed amount.

Distinction has been made in the basic stability factors defined by Linvill and Stern from the point of view of their usefulness in relating power gain. It has been shown that power gain can be expressed more directly in terms of the former parameter. Design charts are provided to eliminate much of the labor of computation.

Previous design procedures have generally required knowledge of the four-pole parameters for the active device. To eliminate the necessity for obtaining these parameters, the basic design procedure has been so translated as to enable one to design an amplifier directly from the device parameters often specified by the manufacturer (viz., $r'b$, $r'e$, ω_t , C_c).

The problem of the sensitivity of transducer gain to device parameter variations is considered. There are many possible terminations which can provide a given stability margin. It is shown that all these terminations, although leading to the same stability margin, do not necessarily yield the same degree of insensitivity to parameter variations. A method to optimize sensitivity for a given stability margin is developed.

Microfilm \$2.75; Xerox \$7.00. 150 pages.

**A STUDY OF FORCED OSCILLATION SYSTEMS
WITH NONLINEAR RESTORING AND
NONLINEAR DAMPING FORCES**

(Order No. Mic 61-2769)

Yen San Lim, Ph.D.
University of Michigan, 1961

The purpose of this study is to investigate forced oscillations of a class of second order systems described by the equation

$$\ddot{x} + f(\dot{x}) + g(x) = e(t)$$

where $f(\dot{x})$ and $g(x)$ represent the nonlinear "damping force" and nonlinear "restoring force" respectively. Emphasis is placed upon determining the boundedness and stability of the solutions.

If $f(\dot{x})$ is a function representing positive damping and $g(x)$ is a function representing positive stiffness, the solutions are shown to be ultimately bounded in a certain region in the phase plane, and this region is explicitly given. When $e(t)$ is periodic, the existence of a periodic solution having the same period as that of $e(t)$ is established by Brouwer's Fixed Point Theorem.

In addition, if the characteristics of $f(\dot{x})$ and $g(x)$ are sufficiently smooth, all solutions are shown to converge to a unique periodic solution which is asymptotically stable. The technique used in the proof involves the application of the Second Method of Lyapunov. A Lyapunov function is constructed to answer the stability question of a second order linear differential equation with variable coefficients which is related to the above nonlinear differential equation. The conditions imposed on $f(\dot{x})$ and $g(x)$ for the stability and uniqueness of the periodic solutions are also determined.

To approximate the periodic solution, a method based on the principle of harmonic balance is developed. A describing function is presented in complex form which is convenient to use and will give quick results of adequate accuracy in practical applications.

Finally, a particular system with combined viscous and coulomb frictions is analyzed, and a computer study is made to corroborate the calculated results.

Microfilm \$2.75; Xerox \$4.40. 84 pages.

**STUDIES OF PLASMA BY
RESONANT ELECTRICAL CAVITIES**

(Order No. Mic 61-1368)

Russell Eddy Lueg, Ph.D.
The University of Texas, 1961

Supervisor: Dr. Archie W. Straiton

An experimental verification of the dielectric behavior of an ionized gas subject to a d-c magnetic field in the region of 10,000 Mc/s is presented. The ionized gas was produced by a d-c glow discharge inside of a cylindrical resonant cavity. The experimental results agreed quite well with the already established theoretical predictions. In addition, electron density and electron collisional frequency were calculated. Another experiment performed

at 400 Mc/s also substantiated the theoretically predicted dielectric behavior of an ionized gas. However, emphasis was placed on determining the actual electron density distribution within a co-axial cavity. Instead of a glow discharge, X-rays produced the free electrons by knocking electrons from the metal walls of the cavity and by secondary ionization of the gas atoms. The experimental electron density distribution was in general agreement with the theoretical predictions. At 10,000 Mc/s average effective electron densities of the order of magnitude of 10^{15} electrons/cubic meter were encountered while at 400 Mc/s densities of 10^{12} electrons/cubic meter were common.

Microfilm \$2.75; Xerox \$5.80. 119 pages.

**ANALYSIS OF THE MAGNITUDE AND
PHASE RELATIONSHIPS IN
MULTI WINDING CURRENT TRANSFORMERS**

(Order No. Mic 61-2431)

Jerome Meisel, Ph.D.
Case Institute of Technology, 1961

An analytic expression for the steady state hysteresis loop of a ferro-magnetic material under the influence of a periodic magnetomotive forcing function is postulated, for curves with a maximum flux level well below the saturation value for the material. A magnetomotive force balance equation is formulated for the current instrument transformer using this approximate expression for the non-linear magnetic effects.

A perturbation procedure is employed to establish a criterion for neglecting all harmonics above the fundamental in the secondary current response to a sinusoidal primary driving function. Compliance with this criterion is shown to be essential for all current instrument transformers, therefore allowing the harmonic balance method to be used with only a fundamental component, thus yielding suitable expressions for ratio and phase angle errors. A two terminal network is investigated to compensate for existent ratio and phase angle errors. Experimental evidence showing the validity of these derived expressions for current instrument transformer performance is provided, in addition to the improvement experienced upon application of the calculated compensation networks.

The usefulness of these results in regard to secondary tapped transformers is discussed, with the conclusion that this previously neglected design now becomes more feasible.

Microfilm \$2.75; Xerox \$6.20. 127 pages.

**A SMALL-SIGNAL ANALYSIS OF
E-TYPE TRAVELING-WAVE DEVICES**

(Order No. Mic 61-2779)

Walter Melrose Nunn, Jr., Ph.D.
University of Michigan, 1961

This dissertation is concerned with a small-signal study of E-type traveling-wave tubes. The investigation includes both a theoretical analysis and an experimental examination.

The theoretical portion of the work is divided into two general phases. The first of these treats the electromagnetic boundary value problem, with special attention being devoted to the allowed field solutions and their formulation in the interaction region. The azimuthally nonre-entrant character of the circular-cylindrical structure, associated with the class of devices studied here, leads to a requirement for general, nonintegral order, real and hyperbolic Bessel functions. The unavailability of these functions has necessitated the derivation of a special set of small-argument approximations which are found to satisfy the required boundary conditions. In addition, a careful consideration of the configuration of a typical E-type device reveals that these simplifications fall within the operating conditions actually encountered.

The electromagnetic analysis not only provides an understanding of the origin and generation of the field components permeating the interaction space in the absence of an energy-carrying electron beam, but it also leads to a general classification of centrifugal-focusing systems and to a prediction of related devices not presently in existence. However, the most important consequences of this study lie in the foundation it provides for an adequate mathematical development of the second part, which treats the electron-wave interaction problem from the viewpoint of the equivalent circuit analysis.

It is primarily this equivalent circuit approach that leads to a prediction of the propagation constants and amplitudes of the excited waves in the presence of an impressed azimuthally-propagating slow electromagnetic wave and a ribbon-shaped electron beam. The circuit and ballistic relations are derived and used in the subsequent development of the generalized determinantal equation, which applies to both forward- and backward-wave E-type devices. The input boundary problem is next formulated and solved in order to obtain predictions of the magnitude of the forward-wave growing- and beating-wave gain, and the backward-wave start-oscillation conditions. The general problem has been solved for a very wide range of operating conditions with the aid of the IBM-704 digital computer.

In addition, the study leads to a small-signal estimate of the efficiency that might be expected from E-type devices. It is found that the important interaction components of the fields are principally azimuthally-oriented, and that the efficiency is comparable to that obtained in O-type devices. Although the study reveals that the E-type incremental propagation constants exhibit properties similar to those of O-type tubes, certain resemblances to M-type devices are also evident. Furthermore, the study reveals that E-type devices possess certain distinctive characteristics not known to other traveling-wave tubes. One of the most important of these is related to the fact that the gain and start-oscillation characteristics of E-type tubes are strongly influenced by the radius of curvature of the ribbon-shaped electron beam following a circular path in the interaction region.

The experimental portion of the study provides a treatment of those factors which exercise control over the laboratory model of the small-signal device. The design data for the tube is used in conjunction with the theoretical analysis to predict the forward-wave gain characteristics of the amplifier. The measured data are then presented for comparison, and an explanation is provided to deter-

mine the probable range of validity of the theoretical analysis. Microfilm \$4.35; Xerox \$15.30. 337 pages.

A GENERALIZED STATISTICALLY OPTIMUM VELOCITY INERTIAL SYSTEM

(Order No. Mic 61-2786)

William Alonzo Porter, Ph.D.
University of Michigan, 1961

In this thesis the author employs the variational calculus techniques of Wiener-Kolmogoroff optimum filter theory to develop the statistically optimum form of a generalized hybrid velocity-inertial system. A generalized velocity-inertial system is considered which is general in both form and application. The form of the system encompasses pure inertial, pure doppler and a large family of doppler-inertial hybrid systems including the present day second- and third-order doppler inertial navigation and stabilization systems. The system may be used for a wide range of applications including any linear combination of acceleration, velocity or vertical-reference sensing.

The general system form is developed by employing two unspecified filters to mix the inertially derived signal with the signal from the auxiliary velocity sensor. It is noted that the algebraic sum of the two unspecified filter transfer functions must total unity at all frequencies if dynamic errors due to vehicle motion are to be avoided. With this restriction and through consideration of the general system, a single general error equation is found which represents the system error for each of the above system forms and applications. This error equation is reduced to the simple form

$$E_r(s) = [I(s) - 1] \epsilon_{ar}(s) + I(s) \epsilon_{br}(s)$$

where $E_r(s)$ is the general system error. The representative error sources $\epsilon_{ar}(s)$ and $\epsilon_{br}(s)$ are particular combinations of component errors which arise from imperfections in the inertial sensors, instrumentation and the auxiliary velocity sensor. The appropriate error source combinations are determined by the system application. Using a linear analysis and the minimum mean-square error criteria, an optimum system form is found for the complete range of possible system applications.

The generalized system representation is further developed by removing the previous restriction on the filter transfer functions thus allowing forced dynamic errors and their effects on system performance to be considered. It is found that these dynamically nonexact systems can be studied within the generalized framework without modification of the principals involved. In addition it is shown that this nonexact system is equivalent to an exact system using a nonexact auxiliary velocity sensor. Hence the optimum nonexact form is an optimum exact system whose auxiliary velocity sensor employs an optimum signal detection filter.

Because the general theory results in an explicit solution for the optimum mixing filter transfer functions in terms of the system error sources, the relative importance of these error sources is clearly seen. A sample calculation and computer simulation for the velocity sensing

case is given to illustrate this insight as well as illustrating the application of the general theory.

Discussions of non-realizable systems and sensor bias problems complement the main theoretical development. In conclusion, this dissertation has organized within a single general framework the many and varied aspects of a whole family of V-I systems; the framework has in turn made it possible to implement the generalized optimization of the family.

Microfilm \$2.75; Xerox \$7.60. 162 pages.

INVESTIGATION OF NARROWBAND WAVEFORMS GENERATED BY CLOCKED PULSES

(Order No. Mic 61-2788)

Marlin Philip Ristenbatt, Ph.D.
University of Michigan, 1961

This analytical and experimental study seeks to find those properties of narrowband waveforms which characterize the waveform as being clocked instead of Gaussian noise, where the waveforms are generated by hard-filtering sequences of constant-amplitude clocked pulses having a random (positive or negative) sign. First the ordinary frequency spectrum of both periodic and aperiodic sequences of pulses is calculated, using the usual methods.

The short-time spectrum of the narrowband waveforms, calculated by writing the output as a sum of filter pulse responses, exhibits a basic half-clock symmetry and other symmetry relations. If the filter passband is located at any of these symmetry points, the short-time spectrum will indicate the presence of clocking.

The variance of the magnitude of waveform samples taken coherently with the clock is calculated, versus phase between the sampling and clock positions. A maximum and a minimum variance relation is found, as a function of the clock-to-filter frequency, for the exponential filter. An analysis and corroborating experiments show that a waveform consisting of the "sum of weighted, sampled variances" can be used to characterize the waveforms as clocked if the waveform is run coherently with the clock.

Zero-crossing calculations for exponential filters show regularity of crossings under certain conditions. Probability density measurements of the zero-crossings show that an exponential filter produces a density distinguishable from noise, but this is not true, in general, for a non-exponential filter.

Microfilm \$2.75; Xerox \$7.20. 152 pages.

A THEORY OF RELATIONS BETWEEN SEQUENTIAL AND COMBINATIONAL REALIZATIONS OF SWITCHING FUNCTIONS

(Order No. Mic 61-1039)

Robert Allen Short, Ph.D.
Stanford University, 1961

It is postulated that a useful theory of relations can be established between important classes of sequential and

combinational digital networks. Such a theory could be useful in describing basic digital processes and in illuminating the essential differences between the two kinds of physical realizations of switching functions. The basic objectives are formalization of these relations and development of procedures for transforming readily from one kind of network to another.

By means of an abstract binary decision element, a particular kind of directed graph is defined that can be variously interpreted as a transfer contact network, a binary-decision program, or a particular kind of state diagram. These correspondences, plus certain functional assumptions, imply a set of rules governing permissible graph interconnections. Further restrictive assumptions extend the correspondences to include iterative combinational networks and conventional state diagrams.

Transformation procedures between graphs with different interconnection rules and different minimization criteria are developed. Finally initial results relating number of contacts to number of states are presented as an example of the utility of the correspondences made within the graph structure. Further work is needed in developing more such general relations and it is hoped that the abstract directed graph can serve as a rigorous structure within which such studies can proceed.

Microfilm \$2.75; Xerox \$6.00. 121 pages.

ENGINEERING, MECHANICAL

AN INVESTIGATION OF THE VARIATION OF INTERNAL HYSTERETIC DAMPING IN METALS AS A FUNCTION OF STRESS STATE AND SPATIAL STRESS DISTRIBUTION

(Order No. Mic 61-2827)

Truman Gray Foster, Ph.D.
The Ohio State University, 1961

Past research in the area of hysteretic-damping energy loss has not emphasized the distinction between material damping and component damping. Little work has been done which has taken into consideration the fact that the configuration of a vibrating component would affect the damping loss. Basic data on material damping and analytical methods to account for the shape and stress distribution are of importance if hysteretic damping loss is to be included in design procedures.

In the present research freely decaying torsional-vibration tests were used to determine the basic damping parameters. These parameters were k and m in the simple law relating the specific energy dissipated by hysteretic damping per cubic inch per cycle to the amplitude of the torsional stress, that is,

$$\Delta w = k (\tau)^m.$$

In the past this law was applied to the case of a solid round bar loaded in torsion. This application was not strictly correct because the stress was non-uniform, i.e., all of the fibers of the specimen were not stressed the

same amount. However, if the torsional specimen were hollow, then the shear stress would be approximately uniform, and this law would more nearly fit the situation. This uniform-shear-stress configuration was used for this investigation. The above law was assumed to apply to the hollow-cylindrical specimen, loaded in simple torsion. It further was assumed that the energy dissipated per cubic inch per cycle at any point of a machine part was a function only of the amplitude of the distortion energy per unit volume at the same point. The distortion energy hypothesis was used as a link between the specific damping in the torsional case and the specific damping in a general multi-axial state-of-stress situation.

Analytical methods were developed to permit computation of a pertinent damping parameter, such as the logarithmic decrement, for general states-of-stress. In these methods the shape of the vibrating component and its general non-uniform stress distribution were the important variable parameters. These analytical methods utilized the basic data obtained in the hollow-torsional-pendulum setup.

Further experiments were made to check the analytical methods developed for these non-uniform stress cases. In the entire investigation three cases were analyzed and tested in detail:

Case I - Hollow round bar loaded in torsion

Case II - Solid round bar loaded in torsion

Case III - Solid round bar loaded in pure bending

Basic experimental data that made use of the hollow torsional pendulum setup were obtained for three materials: 1018 cold-rolled steel, 2024S aluminum alloy, and 304 stainless steel. Specimens made from these same materials were used for Cases II and III. Corroboration data were collected to test the analytical methods and the basic distortion energy hypothesis.

Two general conclusions resulted:

1. For the hollow and the solid torsional pendulums, the experimental data substantiated the analytically developed equations.

2. For the non-uniform bending pendulum, the results substantiated, but not conclusively, the analytically developed equation and the distortion-energy hypothesis.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

THE EFFECT OF COMPRESSION RATIO ON THE ABILITY TO BURN LEAN FUEL-AIR MIXTURES IN A SPARK-IGNITION ENGINE

(Order No. Mic 61-2758)

David Henry Holkeboer, Ph.D.
University of Michigan, 1961

Two aspects of spark-ignition engine operation with lean mixtures were studied: 1) the effect of some engine variables on the minimum fuel/air ratio for steady firing, and 2) the performance of the engine operating with leaner than stoichiometric mixtures.

Analysis of published data on lean mixture limits leads to the conclusion that the minimum fuel-air ratio necessary for flame propagation is a linear function of the

temperature of the reactants, and is independent of the pressure.

Measurements of the lean limit were made in a single-cylinder Cooperative Fuel Research Engine operating at compression ratios of 7, 10, 13, and 16 with propane gas as the fuel. The intake manifold pressure was varied from seven to 19.4 psia, and the intake temperature from 100°F to 300°F. These tests confirmed that the minimum fraction of fuel in the charge for steady firing is a linear function of the compression temperature, and is independent of the compression pressure of the engine. The lean limit predicted in the analytical study was about 35 percent leaner than the minimum fuel-air ratio for steady firing. Qualitative reasons for this difference are given.

The performance of the engine operating with propane-air mixtures ranging from stoichiometric to the lean limit was also investigated. The engine was operated at part throttle at compression ratios of 5.5, 7, 10, 13, and 14.9, at a speed of 1200 rpm with the spark timing set for maximum torque. The maximum indicated thermal efficiency was about 5 percent greater than the efficiency obtainable with a stoichiometric mixture. The fuel-air ratio yielding maximum thermal efficiency varied from 80 percent of stoichiometric at a compression ratio of 5.5 and 70 percent of stoichiometric at a compression ratio of 14.9.

Pressure-time diagrams were obtained to determine the influence of lean mixtures upon the combustion in the engine. Two phases of the combustion process were distinguished: a pressure delay period and a pressure rise period. The delay period, an interval of one to seven milliseconds duration between the occurrence of the spark and the first noticeable pressure rise, was found to increase as the mixture was made leaner and as the compression ratio was decreased. The period of pressure rise had a duration of five to seven milliseconds. It increased as the mixture was made leaner, and was nearly independent of the compression ratio.

Significant conclusions which may be drawn from this investigation are:

1. The fraction of fuel in the charge at the lean limit for steady firing is a linear function of the compression temperature, and is independent of the compression pressure.
2. The maximum indicated thermal efficiency obtained with the engine and fuel used in this study was realized when the mixture was 70 to 80 percent of stoichiometric, depending on the compression ratio and was about five percent greater than that obtained with a stoichiometric mixture.
3. The time interval between ignition and the beginning of the pressure rise was found to be a function of the fuel-air ratio and the compression ratio. The increase in this delay period with leaner mixtures is the principal reason that leaner mixtures required greater spark advance.
4. Further research to gain a more complete understanding of the phenomena which occur during the ignition delay period is needed. Such work might suggest means to minimize the delay period, and/or make possible the utilization of leaner mixtures in spark-ignited engines.

Microfilm \$2.75; Xerox \$7.60. 163 pages.

THE RESPONSE OF LAMINAR INCOMPRESSIBLE FLUID FLOW AND HEAT TRANSFER TO TRANSVERSE WALL VIBRATION

(Order No. Mic 61-2792)

Robert James Schoenhals, Ph.D.
University of Michigan, 1961

The free convection laminar boundary layer adjacent to an infinite plane wall is analyzed for the case in which the wall is vibrated sinusoidally with motion normal to its own plane. A step change in the wall temperature is imposed at the origin so that the wall is heated only for $x > 0$ where x is the dimensionless distance measured along the wall. A perturbation technique is used to obtain the velocity and temperature oscillations in the boundary layer resulting from the time varying pressure gradients generated by the vibration of the fluid. Asymptotic solutions are obtained for large values of $\omega\sqrt{4x}$ where ω is the dimensionless frequency. A second set of solutions is given for small values of $\omega\sqrt{4x}$ based on an integral method. Results are given for Prandtl Numbers ranging from .01 to 1000. Solutions in the two regions are compared by plotting the oscillating components of the wall shear stress and temperature gradient as functions of $\omega\sqrt{4x}$. The two sets of solutions tend to approach each other in the intermediate region so that the entire range of $\omega\sqrt{4x}$ is adequately covered.

The case of transverse vibration of a thin plate of finite length in an infinite fluid at rest is also analyzed. The potential flow pattern is obtained by reducing the time varying problem to an equivalent steady flow situation taken to be the limiting case of an ellipse of zero thickness. A method of successive approximations is used to obtain the corresponding boundary layer response along the wall, and the first two approximations are given. Experimental velocity measurements of the potential flow and boundary layer oscillations along a plate vibrating in air are reported. These measurements are compared with the theory and fair agreement is obtained. Experimental measurements of the vibratory effect on the time averaged convection heat transfer coefficient are also given, and these results are discussed in terms of the analytical work.

Microfilm \$2.85; Xerox \$9.90. 220 pages.

FLUID FLOW AT A SCRAPED HEAT TRANSFER SURFACE

(Order No. Mic 61-2810)

Paul Frederick Youngdahl, Ph.D.
University of Michigan, 1961

This is an investigation of some of the factors which determine the mechanical design of scraped-surface heat exchangers handling fluids with viscosities in the 2,000 to 20,000 centipoise range and low axial flow rates. The fluid to be heated or cooled flows axially in an annular space between a stationary outer cylinder and a powered concentric rotor. The inner wall of the outer cylinder is the heat transfer surface which is periodically scraped by blades attached to the rotor.

The objectives of this work using an experimental apparatus are (a) to make visual observations to determine the nature of the motion of the fluid, (b) to measure the power required to drive the rotor and the blades, and (c) to determine order-of-magnitude heat transfer coefficients. The variables are the type and number of scraping blades, the fluid viscosity, and the rotor speed.

The rotor in the experimental apparatus is approximately 4 inches in diameter with fittings for attaching 0 to 4 axial blades. The stationary outer cylinder is a precision-bored glass tube for making the visual studies and torque measurements, and a composite tube made of a water-jacketed steel section between two glass ends for making the heat transfer observations. A four-speed, rotary, floating drive turns the rotor and measures the torque demands through a strain gage transducer. The working fluids are water solutions of an unrefined polyalkylene glycol.

The results show that full blades which span the annular space between the rotor and the stator mix fluid from the heat transfer surface with the bulk fluid. Rod-type blades which scrape the surface but do not extend to the rotor, do not produce this mixing effect. Equations are developed for calculating the rotor driving torque and an approximate heat transfer coefficient. This coefficient is significantly higher when blades are added to a smooth rotor.

It is concluded that (1) a basis for the design of a scraped-surface heat exchanger has been determined when the modes of axial and rotational flows are in the laminar range, (2) the design of the scraping blades has a marked effect on fluid flow and the heat transfer rate, and (3) full blades which span the annular gap are most effective in their action. Microfilm \$2.75; Xerox \$4.60. 87 pages.

ENGINEERING MECHANICS

CONCENTRATED LOAD ON A SHALLOW ELLIPTIC PARABOLOID

(Order No. Mic 61-1019)

Kevin John Forsberg, Ph.D.
Stanford University, 1961

In problems of shells with finite bending stiffness, solutions have been confined almost exclusively to shells of revolution. The problem to be treated in the present work is concerned with a thin shallow shell having a specific type of deviation from axial symmetry, i.e., the portion of an elliptic paraboloid near its vertex. The problem is further restricted by considering only concentrated loading applied to the vertex. Although detailed results are given only for the case of a concentrated normal load at the vertex, the solutions can be extended to include a concentrated moment or horizontal force as well.

The basic differential equations describing the stresses in an arbitrary shallow shell are expressed in terms of an Airy stress function Φ and the normal deflection w . The homogeneous equation system is solved by reducing the above equations to two identical fourth order equations for two new variables η_1 and η_2 . By transforming the new

equation to polar coordinates and expressing η_1 or η_2 in a Fourier Series, the equation is separable and can be solved. The solution can be written as a power series in a new variable γ

$$\gamma = \frac{1}{2} \frac{a-b}{a+b}$$

where a and b are the major and minor radii of curvature of the shell at its vertex. The coefficients of the γ terms involve the Thomson functions multiplied by $\cos n\theta$. The solution converges in the range $\gamma = 0$ (sphere) to $\gamma = 1/2$ (cylinder).

The deflection and stress resultants are worked out in detail. The coefficients of the γ power series (for the case of a normal load at the vertex) are numerically evaluated and presented in tabular form. These tables allow computation of the deflection and stress resultants for $0 \leq \gamma \leq 1/2$. Additionally numerous graphs are presented for three cases ($\gamma = 0$, $\gamma = 0.3$, $\gamma = 0.5$) to help visualization of the results.

The solution converges rapidly near the origin for all values of γ . Convergence becomes slower as distance from the origin increases. The results also indicate that while the stresses and deformations of a sphere can be considered localized, the deflection – if not the stresses – of the cylinder does not die out as the distance from the load approaches infinity. This indicates that the boundary conditions will have a significant influence on the total deformation picture. This is similar to the situation for the concentrated load on a flat plate, for which the deflection $w = r^2 \ln r$ is not defined until reference is made to specific boundaries.

Microfilm \$2.75; Xerox \$6.80. 142 pages.

MEMBRANE ANALYSIS OF CROSS VAULTS

(Order No. Mic 61-1020)

Ahmet Okan Gürel, Ph.D.
Stanford University, 1961

The membrane theory of shell structures has been widely used in the study of shells of different geometry. The theory gives a dependable answer to many practical problems in engineering. Considering only the normal and shearing stresses in the plane of the shell and disregarding the bending moments and the transverse shear forces, one can carry out the investigation in a fairly simple fashion.

In the present work such an analysis is applied to the cross vaults. Cylinders of arbitrary but symmetric cross sections form a regular cross vault in which the axes of the cylindrical sectors form a regular star. In the first part of the work a general theory is developed for such structures under arbitrary loading. In the process of solution of differential equations of the problem the harmonic analysis proves useful. The theory is also applicable to the cross vaults formed by skew cylinders which have inclined generators rather than horizontal ones. In this case a skew coordinate system is used. The equations derived for the orthogonal coordinate system can be easily modified for this case.

The equations of the problem can be solved by either

the method of Frobenius which yields both the regular and singular solutions, or after certain manipulations can be reduced to a Volterra integral equation of the second kind which can also be solved by known methods.

In the second half of the investigation the general results are applied to two examples. Numerical integration is carried out in one of these examples, and the resulting figures have been tabulated and corresponding stresses have been plotted.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

SOME PROBLEMS OF RELATIVISTIC MECHANICS

(Order No. Mic 61-2442)

Daniel Loring Pope, Ph.D.
Cornell University, 1961

This thesis is in two parts. The problems dealt with are each formulated within the framework of special relativity but are otherwise unrelated. Part I is concerned with the response of a damped relativistic harmonic oscillator. The problem considered in Part II is the possible motions of a relativistic fluid. A suitable description for such a medium is considered in some detail.

In Part I, the well known results describing the relativistic harmonic oscillator are extended to a case including viscous damping in the oscillator configuration. The resulting nonlinear equation of motion contains two important independent parameters. One measures the effect of the relativistic formulation while the other appears due to the inclusion of damping. The solutions of the differential equations resulting when either parameter vanishes, corresponding to the classical damped oscillator and the undamped relativistic oscillator, are known and hence provide a means of verifying the general solution at each stage of its development. A powerful and flexible perturbation technique due to Lighthill is adapted to the requirements of the present problem. The first non-trivial terms of the solution series are found and the method of extending the solution to higher order terms is clearly indicated. In addition a solution is found by the classical perturbation technique of Poincaré for the "nearly Newtonian" case in which the relativistic parameter is much smaller than the one due to damping. This is in excellent agreement with the solution found by the more general method of Lighthill. Several graphical comparisons of the cases considered are included.

Part II deals with the motion of continuous matter in flat space-time. Since no rigid body constraints are involved, this matter is visualized as a fluid and will be referred to as such. The basic hypothesis of this part is taken to be the well known conservation equations

$$\frac{\partial}{\partial x^j} (T^{ij}) = 0 \quad i,j = 1,2,3,4.$$

where T^{ij} is the stress-energy tensor of the fluid. To complete the statement of the problem, an equation of state is prescribed based on the relativistic requirement that the speed of sound in such a fluid be less than or at most equal to the speed of light. The chosen state laws – a one parameter family – are a simple generalization of the

equation of state for a classical incompressible inviscid fluid, to which they all reduce in the Newtonian limit. Fluids obeying such state laws are called simple acoustic fluids. A discussion of alternative methods used for the description of a fluid in relativity is included.

The first general result to be derived is a Bernoulli relation for the flow field. The dependence of the flow constants on vorticity is then demonstrated. If the motion is independent of time in some inertial coordinate system, the non-singular flow fields of classical incompressible hydrodynamics are shown to satisfy the equations of motion for a certain class of simple acoustic fluids.

Both normal and oblique shock waves are treated in detail. Particular emphasis is given to a class of simple acoustic fluids corresponding to the pure photon fluid of Eddington. Shock charts and flow-deflection graphs are obtained for this case. A linearized theory for small deflection angles, closely paralleling classical compressible flow theory is developed. A relativistic Prandtl-Meyer Function is introduced. This part of the thesis concludes with a numerical example illustrating relativistic shock-expansion theory.

Microfilm \$2.75; Xerox \$6.20. 126 pages.

THEORETICAL ANALYSIS OF HEAT TRANSFER FOR THE MAGNETO-HYDRODYNAMIC RAYLEIGH'S PROBLEM

(Order No. Mic 61-2163)

James Tsing-sen Yen, Ph.D.
University of Minnesota, 1961

In this thesis an analysis of heat transfer for the magnetohydrodynamic Rayleigh's problem is carried out. It may be divided into seven parts listed below.

(A) Rayleigh's problem with electrically conducting fluid and heat transfer is defined and formulated in Sections 1 and 2. A connection with the laminar steady semi-infinite flat plate boundary layer problem with non-electrically conducting fluid is mentioned in Section 1. For such non-conducting fluid it is also pointed out here that the heat transfer analysis for Rayleigh's problem is not available in the literature and will be presented in Section 6 as a limiting case with vanishing applied magnetic field and Pr up to 0.1.

(B) The magnetic Prandtl number will be taken as unity, which means the fluid is restricted to a highly ionized gas. The plate is assumed to be a perfect electrical conductor. The Maxwellian displacement current and the surplus charge density will be neglected in the magnetohydrodynamic analysis. These are discussed in Section 2.

(C) The fluid is also assumed to be incompressible with constant property values so that the equations of motion and magnetic field are de-coupled from the energy equation. The internal heat source consists of joule heating and viscous dissipation; they are obtained from the velocity and induced magnetic field solutions given in Reference 4. In Section 3 it is shown that both heat sources should be included in the analysis. Their contributions will be significant for large Eckert number, which is the case for this thesis.

(D) The governing equation for the temperature field is

given in Section 4. There it is solved in transformed space using Laplace-transform and for the four thermal boundary conditions of (1) constant wall temperature, (2) insulated walls, (3) time-dependent wall temperature and (4) time-dependent wall heat flux.

(E) A technique is used in Section 4 to "re-group the singularities within the transformed solution" by adding and subtracting from the solution, another integral. Using this technique, which is justified for $\text{Pr} < 1$ in Section 5 through a proof of uniform convergence, the Laplace-inversion of the solution is replaced, in many places, by successive differentiations. Thereby the analysis is simplified to give exact solutions.

(F) Wall temperature and heat flux thus obtained are checked and extended to $\text{Pr} = 1$ and 2 in Section 6 using Fourier-transform.

(G) The results which are discussed in Section 6 are listed below.

(1) The process of Pohlhausen and Eckert is only approximately valid for our case to the degree indicated in Section 6.

(2) Local temperature without applied magnetic field is less than or at most equal to the corresponding temperature with applied magnetic field.

(3) At large value of $|E|$ the maxima of the temperature may occur inside the fluid for all t . With the presence of the magnetic field, this becomes more pronounced: especially with cooled walls, we may have $T > T_\infty$ for some y .

(4) At large t , $C_p (Tr - T_\infty)/U^2 = \pi^{-3/2} \sqrt{2\text{Pr}} (\sqrt{\nu}/a\sqrt{t})$ and $St = (\frac{1}{2} C_{f_0})(\text{Pr}^{-\frac{1}{2}})$.

(5) Grosh's "slug flow" approximation is valid for $\text{Pr} = 10^{-3}$ if $|E| < 100$ and for $\text{Pr} = 10^{-2}$ if $|E| < 10$.

(6) Effect of time-dependent wall heat flux on fluid temperature is more pronounced than that of time-dependent wall temperature.

Microfilm \$2.75; Xerox \$4.20. 77 pages.

ENGINEERING, METALLURGY

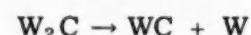
PHASE EQUILIBRIA OF THE TUNGSTEN-CARBON SYSTEM

(Order No. Mic 61-2839)

George Wandell Orton, Ph.D.
The Ohio State University, 1961

Phase equilibria for the tungsten-carbon system are established in a methane-hydrogen atmosphere for the temperature range 900 to 1400°C.

Tungsten monocarbide (WC) is stable between 900 and 1325°C., and the di-tungsten carbide (W_2C) is stable only above 1215°C. A eutectoid decomposition takes place at 1215°C. according to the following reaction:



There is a peritectoid at 1325°C.:



The free energies for the reactions about the eutectoid triple point are determined for the methane-hydrogen atmosphere, for the reaction of tungsten with graphite, and for the behavior of tungsten in a carbon monoxide-carbon dioxide atmosphere.

A revised tungsten-carbon phase diagram is presented that includes the eutectoid and peritectoid transformations, as well as the polymorphic inversion of W_2C .

Microfilm \$2.75; Xerox \$3.00. 55 pages.

RELATIONS BETWEEN MICROSTRUCTURE AND CREEP-RUPTURE PROPERTIES OF NICKEL-BASE ALLOYS AS REVEALED BY OVERTEMPERATURE EXPOSURES

(Order No. Mic 61-2790)

John Paul Rowe, Ph.D.
University of Michigan, 1961

An investigation was conducted to correlate the structural effects of repeated brief overheats to the creep-rupture properties of nickel-base alloys. Overheat temperatures up to 2100°F from a base temperature of 1600°F were studied using M252 and Inconel 700 alloys. The overheats had been applied every five hours for two minutes in the absence of stress. Between overheats, the stress causing rupture in approximately 100 hours in a normal rupture test was applied. The number of overheats varied from a few, up to as many as could be applied before rupture.

The structural changes during normal rupture tests and the alterations induced by overheating were correlated with the creep-rupture properties. Particular attention was given to the relations between the $\text{Ni}_3(\text{Al}, \text{Ti})$ precipitate (γ') and creep resistance, and between the grain boundary phases and ductility.

Due to the rapid reaction rates, brief overheating above the γ' solution temperature dissolved the γ' and caused it to reprecipitate on cooling as a fine dispersion. Repetitive overheating, therefore, prevented the natural growth of the γ' particles. This resulted in increased creep resistance in M252 but caused no change in Inconel 700. Weertman's theoretical analysis of the relationships between a dispersed second phase and creep resistance accounted for this effect. For the testing conditions used, Weertman predicts that creep rate should be proportional to λ^2/h , (λ = inter-particle spacing; h = particle size). For the volume of γ' in M252 (20 to 30 percent), geometrical considerations indicate that λ^2/h varies considerably with h , while at the 30 to 40 percent γ' level of Inconel 700, λ^2/h changes very little with h . Therefore, the refinement of the γ' from overheating would be expected to increase the creep resistance of M252 alloy but not of Inconel 700.

Fracture in the rupture tests resulted from nucleation and growth of microcracks. Nucleation occurred at the

interface between grain boundary carbides and the adjacent matrix. Overheating had no appreciable effect on the M_6C carbides in M252 due to their relatively high solution temperature. Overheating Inconel 700 to 2000°F or higher, however, prevented the $M_{23}C_6$ carbides in this alloy from accumulating in the grain boundaries due to the lower solution temperature for this carbide. A complex mechanism accounting for decreased rupture life of Inconel 700 due to the reduction in ductility resulting from the solution of $M_{23}C_6$ is discussed. Other related structural effects are also included.

The measured amounts of γ' decreased in both alloys during exposure to 1600°F . Whether an actual decrease occurred or the apparent change was the result of an etching effect which gave erroneously large apparent particle sizes when the particles were small, could not be determined from the data. In either case, the geometrical relationships mentioned previously are valid.

A limited study was carried out on compositional effects.

The clarification of the role of γ' dispersion gives insight into previously unexplained effects of heat treatment on γ' -strengthened alloys. Of particular significance is the indication that Weertman's treatment of dislocation concepts applies to engineering materials. Also of significance was the indication that the type of carbide in a material is not so important as its response to exposure conditions.

The major role of high molybdenum content is its ability to promote formation of stable M_6C carbides. The amount of molybdenum which can be included in an alloy composition, however, decreases with increasing $\text{Al} + \text{Ti}$ content since sigma phase tends to form and reduce strength.

The findings of this investigation should have wide general applicability. There are, however, many details which must be considered in any specific case.

Microfilm \$2.75; Xerox \$8.60. 188 pages.

ENGINEERING, NUCLEAR

THE ENERGY DEPENDENCE OF X-RAY DAMAGE IN AN ORGANIC MERCURY COMPOUND

(Order No. Mic 61-2732)

Marvin Cleveland Atkins, Ph.D.
University of Michigan, 1961

The energy dependence of radiation damage to α -acetoxymercuri- β -methoxy hydrocinnamic ethyl ester ($C_{14}H_{18}O_5\text{Hg}$) has been measured in the soft x-ray region. The amount of elemental mercury released per unit energy absorbed from the radiation field was measured at twelve distinct photon energies in the range 9-18 kev. This range includes the L-absorption edges of mercury.

No dependence of yield per unit energy absorbed on the photon energy was found within experimental uncertainty. The *a priori* prediction that there would be no change in radiation yield across the L-edges was verified. Since nearly all the incident photons were absorbed in the mercury atom for all photon energies in this range, these experiments did not test the effect on radiation yield of the site of the initial photon absorption within the molecule.

The compound, prepared and purified in the laboratory, was irradiated in the dry state. The irradiated material was dissolved in alcohol and centrifuged to collect the free mercury released. After successive washing with alcohol, benzene, alcohol, and water, the precipitate was dissolved in a nitric-sulfuric acid mixture. The mercuric ion was determined by a spectrophotometric measurement with dithizone.

Before the energy dependence measurements were undertaken, experiments using both soft x-rays and cobalt-60 radiation (1.17 and 1.33 Mev) showed the mercury yield per unit energy absorbed to be independent of total dose and dose rate over limits much broader than those used in the final experiments. Mercury yields for cobalt radiation and soft x-rays were the same within experimental error.

To obtain a valid curve of radiation damage as a function of energy, the samples were irradiated with essentially monochromatic x-ray beams. These beams were produced by the x-ray fluorescence method. The direct beam from a tungsten target x-ray tube operating at 50 kilovolts peak and 50 milliamperes was allowed to fall on

a radiator made from the element whose K x-ray spectrum was desired. The resulting fluorescent spectrum was filtered to remove the $K\beta$ line. At least 95% of the energy impinging on the sample was carried by the $K\alpha$ line of the radiator, which has a bandspread of only a few electron volts. Absorbed dose rates in the samples were in the range 500-1000 erg/sec.

For absolute dosimetry a soft x-ray calorimeter was developed with a collaborator. In this calorimeter the x-ray beam is absorbed in a 0.002 inch gold foil measuring about 0.6 x 0.9 inches. The temperature rise of the gold plate, which is suspended in a vacuum, is measured by a thermistor in a Wheatstone bridge circuit. The rate of temperature rise is determined over a period of only 30 seconds. This short measurement circumvents the difficult insulation problem in use of a calorimeter of such small mass and large area in an environment not subject to good control. The precision of the calorimeter is estimated at 10% for an energy flux of 400 erg/sec, and 50% at 50 erg/sec. The calorimeter was used as the primary dosimetry standard in this study, with a beryllium window proportional counter being used as a secondary standard.

In the course of this work, a preliminary study has been made of the coloration of crystals of this organic mercury compound by low doses of x-rays. By analogy with published studies on silver halide crystals, the suggestion is made that the coloration may be due to formation of colloidal mercury in the crystal. Studies preliminary to use of organometallics as dosimeters for high doses of gamma radiation have also been accomplished. Microfilm \$2.75; Xerox \$7.20. 155 pages.

FINE ARTS

EARLY CHRISTIAN TOMB MOSAICS

OF NORTH AFRICA.

(VOLUME I: COMMENTARY.
VOLUME II: CATALOGUE).

(Order No. Mic 61-2587)

Margaret Ames Alexander, Ph.D.
New York University, 1958

Adviser: Richard Krautheimer

The tomb mosaic, which marked the spot where a person was buried and which served as a memorial to and identification of the deceased, was a development peculiar, though not unique, to Christian North Africa. Of the more than 500 known examples, over 430 were found in Tunisia and about 90 in Algeria.

Mosaic was first used for pagan epitaphs in Rome and Ostia in the 1st century, A. D. No specific type evolved, and aside from the transmission of the idea, the Roman examples had no direct influence on North African Christian mosaics. The latter arose spontaneously in Tunisia and were quickly adopted in regions where Roman culture and the Catholic Church were firmly established. They developed during a period of turmoil for the Church, marked at the beginning by a struggle with Donatism and later with the Arian Vandals. The numbers decreased rapidly after the mid-5th century, with the growing poverty and increased Vandal persecution. They increased slightly after the Byzantine conquest but ceased about 550.

Tomb mosaics are undated except for twelve, ranging from 427 to 508. To these may be added a sizable group datable from their historical and archaeological contexts. From a seemingly short period of experimentation in the 4th century, a distinctive form was established, consisting of a prominent epitaph and one major symbol or a few minor symbols. More complex types soon developed in which major and minor symbols were combined, crowding the epitaph into a narrow area. This type did not survive much beyond 450; in the later mosaics the epitaph again assumed a major position and the decorative motifs were reduced to a few symbols.

The iconography was within the framework of West Christian funerary traditions. The major symbols were the monogram or cross, the cantharus and the orant; the lesser symbols included various flora and fauna suggestive of Paradise. The latter did not have official connotations but rather the more personal and private meanings relative to the simple faithful. Most of the symbolic and decorative motifs became, in the hands of local craftsmen, merely formulae passed on for generations in the mosaic workshops, copied from pattern books or from existent floor mosaics. Regional styles can be determined, but only the figural representations on the mosaics of Tabarka were distinctive, particularly the orants, with protruding hands, flanked by candles.

The Latin epitaphs and the West Christian symbols, unrelated to native traditions, prove that tomb mosaics were made for Romano-Africans. They were limited primarily to the middle classes who were usually Catholics. Local practices were undoubtedly responsible for their development. In North Africa it was customary to bury the faithful in churches near martyrs or saints. The majority of tomb mosaics were found in churches and probably the choice of medium was conditioned by the North African predilection for paving basilicas with mosaic. These two conditions were not so prevalent in other Mediterranean countries, and sepulchral mosaics were rare and more or less directly related to North African traditions. Except for scattered examples in the 6th and 7th centuries and again in the later Middle Ages, the tomb mosaic died where it was born.

North African tomb mosaics are an important phenomenon not just because they were unique. They contributed a few iconographical variants to sepulchral art. The orant mosaics may have given the impetus to the development of mediaeval European tomb slabs with recumbent effigies. Their dating will help in establishing a chronology for North African Christian architecture. Furthermore, tomb mosaics form a distinct group with which to study North African mosaics in particular and provincial art in general. Microfilm \$7.40; Xerox \$26.35. 584 pages.

THE ART AND ARCHITECTURE OF MAXIMILIAN GODEFROY

(Order No. Mic 61-2641)

Robert Lester Alexander, Ph.D.
New York University, 1961

Advisers: Richard Krautheimer and H. R. Hitchcock

The purpose of this thesis is to study the art and architecture of Maximilian Godefroy (1765-c. 1840), a French refugee architect who spent fourteen years in the United States, primarily in Baltimore. During his stay (1805-1819), the last stages of the Federal period, he was connected with most of the advanced, monumental building undertaken in that city, which was then at a peak of prosperity and importance. His significance lies in his contribution to the rising sense of professionalism in architecture and in the dissemination of French Romantic-Classical doctrine.

Although he learned architecture and building in this country, Godefroy educated himself largely through European sources. Important among these was J.-F. Blondel's *Cours d'architecture* (published 1770-1776), which supplied Godefroy with much of his theory. From personal observation and from other works, like J.-N.-L. Durand's *Precis*

des lecons d'architecture (published 1802-1805), he acquired the compositional methods and forms recently developed in France. Close personal relations with Benjamin Henry Latrobe reinforced Godefroy's efforts to design in a modern European manner.

Quantities of manuscript material, located in American, English, and French archives, throw much light on Godefroy's life, theories, and architecture. His work included a variety of building types: St. Mary's Chapel (1806-1808), the Battle Monument (1815-1825), and the Unitarian Church (1817-1818), to which are added less known structures, the Commercial and Farmers Bank (1812-1813), the Masonic Hall (1812), the Courthouse (1816-1817) in Richmond, Va., other banks, and mortuary, military, and domestic works. Usually with some simplification he adopted favored motifs of the age, like the light, open entrance void in the solid, rectilinear, essentially horizontal block. Employing compositional principles prominent in Europe Godefroy endowed his works with much the same air of compact self-sufficiency and isolation. The sequence of his American works testifies to his increasing understanding and mastery of the new principles and forms. In addition, these structures were imbued with specific symbolic meanings derived from Blondellian theories, an approach which is confirmed and clarified by comparison with Godefroy's allegorical figure compositions and his designs for engravings and sculpture. The eclecticism of Gothic, Egyptian, and Renaissance elements can be seen as a transitional stage preceding the nineteenth-century revivals and linked closer to eighteenth-century ideas on the expression of architectural character.

Godefroy returned to Europe, spending several years in England (1819-1826) and France (1827-c. 1840). Extant buildings in Laval demonstrate his ability to work in a manner which was acceptable outside of a leading center like Paris and which moved closer to Durand-esque practices.

Godefroy's patrons in America were almost entirely members of an upper class which drew its wealth from urban land speculation and mercantile activities. Although this group was losing political hegemony, it retained social and cultural leadership during Godefroy's residence in Baltimore. Working with and for this influential class Godefroy was able to advance the cause of professionalism in architecture, joining his efforts with those of Latrobe who also felt the xenophobia of local mechanics and native-born builder-architects. In return for patronage Godefroy created through his style an architectural expression for that part of the community which maintained a cultural orientation toward contemporary Europe.

Microfilm \$5.65; Xerox \$20.05. 442 pages.

CARRIAGE, COACH, AND WAGON: THE DESIGN AND DECORATION OF AMERICAN HORSE-DRAWN VEHICLES.

(Order No. Mic 60-5656)

William Louis Gannon, Ph.D.
State University of Iowa, 1960

Chairman: Professor Charles D. Cuttler

This work, a general history of the design and decoration of American horse-drawn vehicles, presents the case for certain vehicles as lesser works of art worthy of preservation and deserving further study by students of American art and culture.

American coachbuilders of the eighteenth century were not able to improve upon the designs of Europe. The most original vehicle types of that period were those designed for the common man: the chair, pleasure wagon, and Conestoga wagon -- forms rising from a genuine need for durable and efficient transport and requiring only readily available materials in their construction.

Before 1830 the invention of the elliptical spring made possible the design of the buggy and spring wagon, soon to replace the chair and pleasure wagon because of a greater approximation to the ideals of strength and lightness along with an adaptability to quantity manufacture. The adoption of woodworking machinery and the growth of markets soon led to the establishment of the factory system. At about the same time the introduction of the French Rule system of carriage design revolutionized the appearance of American coaches and fine carriages.

Two subsequent schools of taste, an Anglo-American style in the North and a Franco-American style in the South, flourished together until the outbreak of the Civil War, when the ornate Southern style came to an end. After the Civil War, Victorian canons of taste dominated coach and carriage styling in America.

The tradition of painted ornament, scrollwork, and pictorial panels was retained with uninhibited gusto on the stagecoach and omnibus until the end of the nineteenth century. Carvings and painted ornament, along with a riotous iconography, appeared at an early date on the American circus wagon. The business wagon did not appear in its full glory until after the eighth decade.

Artists and craftsmen of the carriage industry were among the few who were able to maintain and improve the standards of an eighteenth century craft in the face of an advancing technical civilization. It was not until the development of small powerful motors that the craft was forced into a decline. It struggled mightily to preserve itself and successfully imposed its forms on the earliest automobiles and, from wooden wheels to extension tops, many of its creations survived through the first quarter of the twentieth century.

A fine carriage was an architectonic achievement involving the use of many seemingly incompatible materials in smooth combination. The best forms were designed not only with regard to the aptness and efficiency of the vehicle as a conveyance, but also with regard to its function as a symbol of prestige and social order. It can be defined as art from the standpoint of either fine art or functionalist aesthetics, and is, in many cases, a captivating symbol from a very great period in the stream of American history.

Microfilm \$5.40; Xerox \$19.15. 423 pages.

**A STUDY IN THE PROBLEMS
OF SELF-PORTRAITURE.
THE SELF-PORTRAITS OF PAUL GAUGUIN.**

(Order No. Mic 61-2667)

Ruth Deborah Rothschild, Ph.D.
Columbia University, 1961

This investigation attempts to show that Paul Gauguin and his contemporaries' attention to the self-portrait reflects the general interest in the self-image in France at the end of the nineteenth century. The subjective quality in the Post-Impressionists' work is suggestive of self-preoccupation. Despite a large production of self-portraits by some artists in the past, differences in styles, dates, and causes for self-depiction make it expedient to limit this discussion to Gauguin, his contemporaries, and their immediate predecessors--the Impressionists.

Independent of patrons, the artist now had to struggle for his existence, and this exertion gave him pride in himself and in his profession. Self-portraiture enabled the artist, among other things, to demonstrate this self-respect. Gauguin, Van Gogh, Cézanne, and Degas each made around thirty or more self-portraits. The student can make certain inferences about the artists' personalities by studying a sequence of such portraits for placing, the importance given to the parts delineated, the expressions, and other revealing factors.

Restless in temperament and unable to feel close to others, Gauguin was thrown back upon himself. Rootless, he ultimately travelled to Tahiti in a partially successful attempt to satisfy his longing for a more primitive type of existence. But monetary troubles, ill health, unrealized dreams of recognition, and feelings of neglect by his friends plagued him there too. Faced with real, if largely self-created hardships, his main concern was always himself, his art, and the role of the artist. Despite his difficulties, he repeatedly proved to have great vitality and considerable artistic sensibility. Gauguin's style was direct, informal, and personal. The choice of color was determined by feeling, and lines and shapes were inventive, rather than a correct description of the object. The subject's emotional disposition was strongly suggested in the poses. Although recognizably a part of nature, the subject matter often was presented so individually that the observer could only partially grasp its meaning. Gauguin's self-knowledge was gained either through observation of his physiognomy in the mirror, in a photograph or a portrait of himself, or in less conscious personal projections obtained by letting the hand wander freely over the canvas. In his work one is continuously aware of Gauguin, not only in the mirror studies, but even when a resemblance to his features has been projected upon another face, or when a symbol of himself or some subject matter indirectly but intimately concerned with himself and associable with his verbalized reminiscences has been delineated.

By utilizing modern psychological knowledge, an attempt is made to get new and deeper insights into Gauguin's personality in order to understand his art more fully. The results obtained by studying his writings, his portraits of others, their portraits of him, photographs of him, and comments about him agree closely with the impression gotten from the conscious and less conscious self-portraits. Thus, although stylistically self-portraits resemble the rest of his work, more is learned from them

about his concept of himself as a person and as an artist than could be learned from any other subject matter.

Microfilm \$4.25; Xerox \$15.10. 331 pages.

**A STUDY OF THE ARCHITECTURAL
IMAGERY OF FRANK LLOYD WRIGHT**

(Order No. Mic 61-2668)

Norris Kelly Smith, Ph.D.
Columbia University, 1961

There is undertaken in this essay an initial inquiry concerning the relationship between Wright's ideas, as one finds them expressed in his books and articles, and the shapes he devised for his buildings. The period covered extends from 1892 until 1940.

Chapter I. It is argued that architecture is an inherently conservative art, and that Wright's in particular is conservative in style (i.e., sober and restrained, in contrast to the exuberant architecture of the 1870's) and in purpose; for its purpose is held to be that of defending the institution of the family at a critical point in its history and, in addition, to preserving an image of the free individual which Wright had received from his Unitarian forebears--an image inseparable from the names of Emerson and Whitman.

Chapter II. Wright's self-image and outlook are shown to be related to a particular strain of Romanticism which descends from Rousseau by way of Goethe, Carlyle, Emerson, and Nietzsche. One characteristic of that strain is held to be its propensity toward polarities--a proclivity which manifests itself, both in nineteenth-century romanticism and in Wright's own thought, in a concern for the interrelationship of the arts of architecture and music (arts which gravitate toward the polar extremes of static and dynamic, institutional and personal, essential and existential, etc.).

Chapter III. Between 1893 and 1909 Wright seems to oscillate between two conceptions of the house and of the family: the one emphasizes the closed and sheltering unity of the house as a whole, the other, the relative independence of the parts from one another and from a regulatory principle belonging to the house as a whole. Within the single house a similar contrast is often found between the severely formal dining room and the casually informal living room. All Wright's public buildings from this period are regular and symmetrical in design, or like the dining rooms.

Chapter IV. In 1909 Wright abandoned his practice and his family, for the reason, it would appear, that he had failed--failed to realize his image of the free, Whitmanesque individual within the confines of suburban conventionality; failed to reconcile the conflicting demands of freedom and of membership; failed to maintain the radical distinctiveness of his own style, which had become so fashionable as to appeal to respectable multi-millionaires such as Coonley, McCormick, and Ford.

Chapter V. Having rejected, and been rejected by, the city, Wright made a new beginning at Taliesin in 1911, rooting the structures both of his house and of his extra-legal marriage in nature rather than in the city's

patterns. That beginning was cut short by destruction in 1914, whereafter Wright, rootless and adrift, devoted himself for several years to constructivist projects almost unrelated to his earlier work.

Chapter VI. Because of the depression, it became possible again in the 1930's for Wright to speak forth as a reformer in the Rousseauistic, antiurban tradition. In 1936 he achieved the fullest realization of his polaristic conceptions with the designing of Fallingwater, which has to do with openness, freedom, privacy, and nature, and of the Johnson Building, which pertains to containment, loyalty, collectivity, and the city.

Chapter VII. Fallingwater and the Johnson Building are compared with Emile and The Social Contract, respectively: the first member of each pair is an affirmation in favor of the liberty of the natural man, while the second is an equally ardent declaration in favor of social order. These two extremes may be related to the two Christian images of paradise--the New Eden and the New Jerusalem. Wright's Broadacre City plan is discussed in relation to The Social Contract and is interpreted as an image of paradise, lying above and beyond history--a paradisiacal order in which Eden and Zion are finally reconciled.

Microfilm \$3.25; Xerox \$11.50. 251 pages.

FOOD TECHNOLOGY

RELATION OF SULPHYDRYL GROUPS TO THE FADING OF CURED MEAT

(Order No. Mic 61-2256)

Morton Sylvan Cole, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: John C. Ayres

A study was made of the relation of free sulphydryl groups to fading of cured meat pigment in the presence of oxygen. Treatment of cured meats with mercuric chloride, which reacts with sulphydryl groups, increased the stability of the meats to light. The 650/570 mu reflectance ratio was not suitable for demonstrating changes in cured meat color. The Gardner Color Difference Meter provided the most satisfactory means of color measurement.

Manometric experiments on systems containing native pigment, cysteine and an unsaturated fat indicated that sulphydryl groups were involved in an oxidative reaction. The prooxidant effect of cysteine in this system was demonstrated by separating the oxygen consumption provided by the hematin catalyzed oxidation of methyl linoleate from that caused by sulphydryl catalysis. The concentration of lipid and cysteine influenced the occurrence and degree of the prooxidant effect by cysteine.

Cysteine catalyzed the oxidation of methyl linoleate in the absence of heme pigments. The metal complexing agent ethylenediaminetetraacetic acid (EDTA) inhibited the oxidation of linoleate by cysteine alone as well as the hematin catalyzed oxidation of linoleate in the presence of cysteine. EDTA had no effect on the hematin catalyzed oxidation of linoleate in the absence of cysteine.

Ferric and ferrous ions had a greater prooxidant effect in the presence of cysteine than did cupric, cobaltous or nickelous ions. Ferrous ion was the only metallic ion of those tested which actively catalyzed linoleate oxidation in the absence of heme pigments and cysteine.

A green pigment formed when cysteine and linoleate reacted with native myoglobin was identified as sulfmyoglobin. Sulfhemoglobin was less active in the catalytic oxidation of methyl linoleate than was hemoglobin. The prooxidant effect of cysteine and the production of sulfmyoglobin occurred within a pH range of 3.5 to 5.1.

Oxidation of cured meat pigments in model systems was inversely proportional to linoleate oxidation. In addition, the red color of cured meat samples exposed to light decreased proportionately to the increase in fat peroxide value. EDTA decreased but did not completely inhibit linoleate and cured meat pigment oxidation. The antioxidants nordihydroguaiaretic acid, butylated hydroxyanisole, butylated hydroxytoluene and propyl gallate inhibited both linoleate and denatured globin nitric oxide hemoglobin oxidation.

The effect of light was studied in suspensions of cured meat pigment in gelatin. The color of these suspensions decreased in proportion to the increase in cysteine concentration. Most color loss occurred in the presence of cysteine and methyl linoleate. The pigment alone was only slightly altered by light in the absence of cysteine and/or linoleate.

It is proposed that cured meat fades by the co-oxidation of pigment and unsaturated fats. Free sulphydryl groups and trace metals accelerate this reaction.

Microfilm \$2.75; Xerox \$5.40. 110 pages.

THE SIGNIFICANCE OF RENNIN AND PEPSIN IN RENNET

(Order No. 61-2964)

Peter Munro Linklater, Ph.D.
The University of Wisconsin, 1961

Supervisor: Associate Professor C. A. Ernstrom

A test of the importance of rennin, and other fractions of rennet in cheese manufacture was obtained by comparing cheese made with crystalline rennin, commercial rennet and the supernatant solution remaining after removal of about 80 per cent of the clotting activity from rennet. The amount of these solutions used in cheese manufacturing was based on conventional estimates of their clotting strength in a substrate prepared by dissolving 60 g. of non-fat dry milk (NDM) in 500 ml. of 0.01 M CaCl_2 . Cheese milk was coagulated with these clotting solutions and the

strength of the resulting coagulum was measured with a Cherry Burrell curd meter. Eight lots of cheese made with each clotting solution were analyzed for moisture, total nitrogen and soluble nitrogen; and the cheese graded at 2, 10 and 34 weeks.

All the cheese were of good commercial quality, and there appeared to be no differences among the cheese made with the three solutions. Good quality cheese was made with crystalline rennin, and the non-rennin fraction of rennet did not contribute to cheese quality. The only component in commercial rennet essential for cheese manufacture under these conditions appeared to be the enzyme rennin.

There was no obvious reason why the crystalline rennin treatment produced the highest level of soluble nitrogen, and the supernatant the lowest level with the commercial rennet intermediate between the two. It was hypothesized that pepsin in the rennet and the supernatant solution caused these differences. Measurement of the clotting strength of a mixture of rennin and pepsin in the CaCl_2 substrate did not predict accurately the clotting strength in skim milk. The relative clotting activity of pepsin and rennin in the calcium enriched substrate is not maintained in skim milk.

A method was developed to determine the pepsin activity in commercial rennet samples. Ten samples tested by this method revealed that pepsin contributed from none to 3.7 per cent of the milk clotting strength.

Evidence was obtained that the conversion of prorennin to rennin in fresh rennet extract containing 15 per cent NaCl might not be autocatalytic as had been supposed. Partially purified prorennin could not be activated in the presence of 15 per cent NaCl at pH 4.7. The addition of pepsin to prorennin under these conditions produced activation approximately proportional to the amount of added pepsin. The addition of rennet to prorennin, under the same conditions, produced activation of the prorennin at a rate which depended on the measured pepsin content of the rennet. It was concluded that pepsin plays a major role in the activation of prorennin under conditions of commercial rennet manufacture.

Microfilm \$2.75; Xerox \$3.00. 51 pages.

RELATION OF PHYSICAL, CHEMICAL AND SENSORY EVALUATIONS OF PORK LOIN QUALITY TO THE BACKFAT THICKNESS OF HOG CARCASSES.

(Order No. Mic 61-2266)

Luz Uichanco Oñate, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Agnes Frances Carlin

Paired loins from 48 pork carcasses varying in backfat thickness by increments of 0.1 inch from 1 to 2.3 inches were studied. One loin from 3rd to 10th rib in each pair was tested raw; the other loin was tested after roasting at 325°F. to an internal temperature of 185°F. Data obtained included degree of marbling, cooking losses, yield of fat, lean and bone, tenderness measured by shear force and sensory evaluation of flavor, tenderness and juiciness

of pork roasts. Moisture, fat and protein content was determined on raw and cooked roasts from the anterior portion of the loins. Similar analyses were made on raw and braised chops from the posterior part of these loins. Energy value was determined in the Parr adiabatic calorimeter on braised chops from one loin in each of the backfat classifications.

Results indicated that marbling of raw longissimus dorsi muscle at the 10th rib was not related to backfat. Regression analyses of data on cooking losses indicated that percent total cooking losses for roasts increased significantly ($b=2.2$) and percent drip loss also increased significantly ($b=3.5$) with 1 inch increase in backfat. Cooking losses for all rib roasts were 21% for total, 6% for drip and 15% for volatile losses.

Backfat thickness was a good indication of yield. Separable fat in raw roasts increased 13% and in cooked roasts increased 9%; whereas, lean decreased 10% in raw roasts and 9% in cooked roasts as backfat increased 1 inch. Regression analyses indicated that these results were highly significant. Comparison of yields of fat and lean in raw and cooked roasts without regard to backfat thickness indicated that yield of lean was similar for the raw (52%) and cooked (53%) roasts. However, yield of fat for raw (24%) was higher than for cooked (19%) roasts. Shear force values indicated that cooked roasts were less tender than raw roasts. Raw roasts and chops were similar in chemical composition, and had approximately 71% moisture, 6% fat and 22% protein. Cooked roasts had 62% moisture, 10% fat and 26% protein. Cooked chops had approximately 54% moisture, 10% fat and 34% protein. Gross energy value or heat of combustion of 292 Calories per 100 grams determined in the Parr adiabatic calorimeter compared favorably with 293 Calories per 100 grams calculated from fat and protein content. Energy value of cooked pork chops was not related to backfat. Flavor, tenderness and juiciness of rib roasts as determined by a taste panel were not affected by backfat thickness of hog carcasses.

Microfilm \$2.75; Xerox \$6.60. 136 pages.

A STUDY OF ORGANISMS FOR BIOASSAY OF RESIDUAL TOXICANTS ON RAW FOOD PRODUCTS

(Order No. Mic 61-2846)

Radcliffe Franklin Robinson, Ph.D.
The Ohio State University, 1961

The use of invertebrate organisms for the bioassay of residual toxicants on foods depends on their sensitivity to low concentrations of insecticides and the use of a method by which the toxicant can be concentrated when extracted from the food. The sensitivity of forty aquatic invertebrate organisms, representing most of the lower phyla, was determined to five organophosphate insecticides: malathion, methyl parathion, parathion, demeton, and EPN. The organisms were exposed to 1 to 24 ppm concentrations of the toxicants, and behavior, knockdown, death, and unique physiological reactions were observed.

Three insecticides, parathion, methyl parathion, and EPN, were dried on the surface of fresh snap beans at a concentration of 1 ppm by weight and recovered with

petroleum ether. The ether was evaporated and the residue redissolved in water to give a final concentration of 8 ppm of toxicant. This solution was bioassayed with sensitive invertebrate organisms.

The members of the phylum Arthropoda showed a greater sensitivity to the toxicants than did those of the lower phyla. Daphnia longispina and Monostyla sp. were affected by all the insecticides used. Six organisms showed a reaction to four of the toxicants: Stylaria fossularia, Asellus militaris, Planaria maculata, Bursaria truncatella, Crangonyx gracilis, and Cyclops vernalis.

In the bioassay research, six of the organisms correctly indicated the amount of toxicant theoretically present. Thirteen of the 20 organisms used indicated correctly the range of concentration of the toxic residue recovered from the beans, and Copepoda falcis and Monostyla sp. gave accurate results with more than one toxicant. The use of aquatic invertebrate organisms is feasible for monitoring the residual insecticides on food products when a rapid method of toxicant extraction is used.

Microfilm \$2.75; Xerox \$5.60. 113 pages.

GEOGRAPHY

TYPES AND PROBLEMS OF LAND USE IN THE COLUMBIA BASIN PROJECT AREA, WASHINGTON.

(Order No. Mic 61-2772)

George Macinko, Ph.D.
University of Michigan, 1961

The purpose of this study is to describe the land use history of the project area with emphasis on contemporary irrigation agriculture, to analyze the factors responsible for changes in land use, and to examine and furnish an interpretive account of the major problems involved in each type of land use. The study has importance because the Columbia Basin Project represents the largest single venture by the federal government in the field of irrigation development and the results of this project may have far-reaching consequences in reclamation activities throughout the nation.

Library research reveals that an Indian occupancy based on raising and trading horses gave way to a system of open range livestock grazing by white men shortly after the Civil War. Scanty water supplies, winter cattle losses, and the success of wheat growers in the late 1880's caused a decline in grazing activities. Wheat farming spread throughout most of the project area between the years 1900 and 1910. Documentary and field research indicates that by 1911 weed and wind erosion problems accompanied by decreasing wheat yields showed that much of the project area was unsuited to grain production; farming activities then began a long-term decline.

Failures experienced in dryland farming served to stimulate interest in irrigation development. Irrigation agriculture had never occupied large amounts of project land and none of the early irrigation schemes were unqualified successes. Basic to all failures was the fact that water users could not receive enough money from crop returns to pay the cost of irrigation facilities. It soon became evident that federal aid would be needed to irrigate any large portion of the project area.

Construction of Grand Coulee Dam, which began in 1934 as a move to alleviate unemployment, ushered in the contemporary land use scene. A marginal dryland farming area was transformed into one of diversified irrigation

agriculture with a greatly increased industrial base. Despite detailed planning efforts, actual land use differed from that envisioned. The failure of livestock numbers to meet expectations resulted in an emphasis on row crops at the expense of hay and pasture production. Detailed field study of the first area to receive water revealed that the livestock-forage type of land use envisioned by planners may yet prevail, but only because weed and disease problems in combination with low prices on row crops force project farmers in this direction.

Constantly increasing construction costs have led the Bureau of Reclamation to attempt to renegotiate repayment contracts with water users. Renegotiation proceedings were hindered by the fact that the repayment abilities of farmers could not be determined with precision. Provision of adequate drainage at a cost within the payment ability of water users figured prominently in renegotiation proceedings. Many problems stemmed from the vast social and economic changes that had taken place during the time lag between project planning and implementation of such plans.

Several conclusions can be drawn from the study. Previous land use systems were marked by maladjustments of land use to environment. Despite the best efforts of planners, serious problems have arisen in the contemporary land use scheme, and future growth and development of the project are uncertain. Many problems could have been avoided by an immediate implementation of plans.

Microfilm \$2.75; Xerox \$9.25. 201 pages.

THE DENVER & RIO GRANDE WESTERN RAILROAD: A GEOGRAPHIC ANALYSIS.

[To obtain copies, order directly from
Northwestern University Press, Evanston, Illinois.]

Frank Henry Thomas, Ph.D.
Northwestern University, 1960

The purpose of this study is twofold: (1) to analyze for the year 1956 the relationship between the actual traffic origination of selected commodities and the potential traffic

(production) of these commodities in counties of the Denver and Rio Grande Western Railroad hinterland, and (2) to describe with the aid of maps the actual origination and flow patterns of these commodities.

The relationship between railroad potential and actual traffic is stated in terms of a device expressed as a percentage and designated the traffic capture ratio. The railroad capture ratio is defined as the percentage of potential traffic actually originated by the railroad. Interpretation of the value of the railroad capture ratio is attempted by testing the following three hypotheses for their positive relationship to the value of the capture ratio: (1) Commodities with a long average length of haul have a high railroad traffic capture ratio since trucks are more effective and economical short haul carriers. (2) Commodities with a low value per ton have a high railroad traffic capture ratio because the necessary low carload freight rates are provided by railroads. (3) Commodities with a high concentration of potential originating traffic have a high railroad traffic capture ratio because the truck advantage of flexibility is minimized and volume shipments are favored. Each of the commodities upon which the above hypotheses are based, is also associated with areal specialization of production and regional interdependence.

Value per ton, length of haul, and concentration of potential traffic were examined for their relationship to the railroad traffic capture ratio of 17 commodities selected on the basis of tonnage important to the D & RGW. Singular examination of each of the three factors revealed a need for weighting the importance of each. Use of an estimating equation for a line of least squares fit provided capture ratio estimates which were not in complete accord with actual capture ratios thus indicating unsatisfactory weighting because of the presence of extraneous factors. Railroad competition was identified as an important extraneous factor. A new estimating equation derived from

data adjusted for railroad competition increased the number of estimated capture ratios approximating actual capture ratios. Though weighting of value, haul, and concentration was improved, evidence indicated that other extraneous factors remained and that the weighting was unsatisfactory. Examination of four commodities with estimated capture ratios that failed to approximate actual ratios suggests that the extraneous factors include special situations such as: (1) exempt commodity itinerant trucker competition, which affects agricultural commodities; (2) originating traffic requirements associated with production, for example, grain elevators for wheat, stock pens and yards for livestock; and (3) transportation requirements, for example, refrigerator cars for peaches, double-deck livestock cars for sheep, and bulkhead flat cars for wallboard. It is concluded that the generally accepted explanations of railroad traffic origination in terms of long haul, low value, and concentration production are not satisfied as herein quantified.

The concepts of regional specialization of production and regional interdependence are difficult to operationalize. However, the analysis of flow patterns reveals the basic organizational structure of the D & RGW hinterland and provides an indication of the importance and nature of regional specialization.

The organizational structure of the D & RGW hinterland is composed of two basic types of regions and two basic types of regional relationships. The two types of regions are the urbanized region and the non-urbanized region. The two basic levels of regional relationship are represented by intra-hinterland traffic and extra-hinterland traffic. Classification of the leading commodities originated traffic flow patterns reveals that the most important commodity regional relationships indicate specialization of production for markets external to the D & RGW hinterland.

GEOLOGY

PIERCMENT FEATURES NEAR CAMERON, ARIZONA:

PART 1.—A BRECCIA PIPE AT BLACK PEAK.

PART 2.—COLLAPSE FEATURES AND
SILICA PLUGS.

PART 3.—ALTERATION OF TUBA DIKE.

(Order No. Mic 61-2654)

Jonathan Barrington, Ph.D.
Columbia University, 1961

Four types of penetrative structure have been examined in the vicinity of the Cameron uranium mining district, Arizona. These include a breccia pipe, collapse features, silica plugs and a monchiquite dike. Each of these features displays mineralization, associated bleaching of the surrounding flat lying sediments and argillic

alteration, and they apparently represent centers of hydrothermal activity which are possible primary sources of uranium in the Cameron area.

Black Peak protrudes above a tableland of Navajo sandstone on the Colorado Plateau just east of the Echo Cliffs escarpment and 30 miles north of Cameron, Arizona. A breccia pipe occurs on the west slope of the Peak near small monchiquite dikes partly subjected to intense argillic alteration. The pipe contains breccia fragments of sandstone, mudstone, shale and altered dike rock believed to have been plucked from the wall rocks and transported upward.

A vesicular, silicified collar several feet thick surrounds the pipe. Minute microacicular quartz overgrowths which occur on crystals of quartz in the wall rock suggest a high temperature aqueous environment and the pipe may have been formed by the almost explosive penetration

of superheated steam. Irregularly distributed argillic alteration, silicification and mineralization suggest subsequent hydrothermal activity.

The Peak is an elevated indurated feature in the Navajo sandstone indicating vertical penetration by fluids of magmatic origin from below, which suggests the original source and one phase in the mechanism of introduction of mineralization in the Cameron area.

Collapse features and silica plugs occur in the vicinity of the Cameron mining district. The plugs appear as small, dark cones which rise a few tens of feet to 75 feet above the surrounding Plateau strata, and are believed to have been formed by the deposition of silica from hydrothermal solutions ascending along vertical channels or pipe-like conduits. Solution deposited silica cements rounded cores which contain breccia fragments, conglomeratic pebbles and coarse sand grains, providing resistance to erosion.

Silicified breccia, bleaching and argillic alteration also occur within slumped areas of collapse features in association with uranium mineralization. These indicate the activity of solutions which apparently caused localized collapse in the Permian Kaibab and overlying Triassic formations as a result of the removal of carbonates from underlying carbonate-bearing formations.

Examination of the mineralization associated with both plugs and collapse features indicates the introduction of U, Cu, S, P, Si, Fe and Mn. Most of the features are radioactive.

The Tuba dike is a monchiquite dike approximately two miles long which crops out in the lower Jurassic sediments along the northern edge of the Painted Desert 12 miles northeast of Cameron. The dike strikes almost due north and forms a low spine-like ridge rising out of the blow sand covered sediments.

The dike rock has a porphyritic texture consisting of olivine and calcite- and chlorite-replaced olivine phenocrysts in a matrix of interlocking augite blades. Fractures filled with calcite are aligned parallel and across the dike. Two carbonate-filled pipes lie just west of the center of the dike. Argillic alteration of sedimentary montmorillonite to illite, concentrated in the sediments immediately adjacent to the dike, has produced relatively resistant borders of a wall-like nature at the dike contact.

Deuterian alteration, calcite mineralization and argillic alteration indicate considerable hydrothermal activity associated with the formation of the dike.

Microfilm \$2.75; Xerox \$8.80. 193 pages.

GEOPHYSICAL STUDIES IN THE FILCHNER ICE SHELF AREA OF ANTARCTICA

(Order No. 61-2941)

John Charles Behrendt, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor George P. Woollard

Geophysical and glaciological results of the 1957-58 and 1958-59 traverse parties operating from Ellsworth Station have been integrated in an attempt to give a unified picture of the Filchner Ice Shelf and its environs. The fol-

lowing conclusions are presented and discussed. A large trough underlies the eastern section of the ice shelf and extends back into the unexplored head of the shelf. Berkner Island is a grounded ice feature on Berkner Bank, a vast morainal area extending far out into the Weddell Sea. The eastern section of the ice shelf is flowing forward at a high velocity and the vast amount of ice lost at the ice front is not balanced by accumulation over the shelf area. A large amount of the high ice of East Antarctica is probably drained by the eastern portion of the shelf entering via the Recovery and Slessor Glaciers and the wide ice stream apparently flowing down between the Dufek Massif of the Pensacola Mountains and the Horlick Mountain Range. After passing the constriction caused by Berkner Island and Coats Land the ice shelf thins rapidly by spreading as the Weddell Sea is approached. Any freezing or melting at the bottom of the shelf is insignificant. It is suggested that Berkner Bank and the trough were formed at some past time of lower sea level by glacial action. The area beneath the Filchner Ice Shelf is essentially in isostatic equilibrium and the thickness of the earth's crust is consistent with that to be expected for a continental margin.

Microfilm \$2.75; Xerox \$8.80. 191 pages.

GEOLOGY OF THE GUNNAR URANIUM DEPOSIT, BEAVERLODGE AREA, SASKATCHEWAN.

(Order No. 61-2951)

Ernest Franklin Evoy, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Eugene N. Cameron

The Gunnar orebodies are brecciated and mineralized portions of small syenite bodies that lie within gneissic granite. Part of the syenite consists almost solely of albite; the remainder consists of albite and calcite. The ore minerals are pitchblende and uranophane. The latter is generally regarded as a supergene alteration product of primary uranium minerals but at Gunnar it is present to a depth of 1,400 feet below the water table. This report attempts to establish the relationships between granite and syenite and between syenite and ore mineralization. The ore assemblage is examined with emphasis on genesis and the position of uranophane in the paragenetic sequence.

Field mapping has been followed by microscopic examination of the petrography and ore textures. Flame photometric analyses have been used to confirm variations in the alkali content between granite, syenite and ore. The oxidation state of the orebody, and its variation with depth, have been studied by analyses of total uranium and hexavalent uranium.

This research indicates that the syenite includes rocks of two separate but related origins. Albite syenite was derived by albitization of the granite gneiss prior to ore mineralization. Calcite syenite resulted from replacement of quartz by calcite in partially albitized granite, and the process accompanied ore deposition. The superposition of one alteration over the other resulted from a common structural control.

Some supergene alteration occurred within the upper

100 feet of the orebody, but this was *in situ* alteration and did not produce any enrichment. Uranophane is considered to be primary. The ore minerals are hydrothermal in origin and were probably transported in alkaline carbonate solutions. Precipitation was favored by a decrease in pressure when the ore solutions entered the brecciated and porous albite syenite, and by a temporary change from an alkaline to an acid environment.

Microfilm \$2.75; Xerox \$4.80. 92 pages.

**SIGNIFICANT FORAMINIFERA
IN THE AUSTIN GROUP**

(Order No. Mic 61-2123)

Louis deAgramonte Gimbredre, Ph.D.
Louisiana State University, 1961

Supervisor: Professor H. V. Andersen

This dissertation presents the results of a study of the relationship of the foraminiferal fauna to the stratigraphy of the Austin group. Approximately three hundred samples were collected from exposures between San Antonio and Waco, Texas from which the data have been assembled.

Selected species of Foraminifera are presented on a range chart to illustrate their succession in the "Type" area near Austin, Texas. Of these, Citharina texana (Cushman) is shown to be present in all but the lowest portion of the Austin group and to be absent from younger beds. Kyphopyxa christneri (Carsey) is shown to evolve from Palmula suturalis (Cushman) in the middle chalk member of the Lower Austin and to characterize all younger beds in the group. A faunule characterized by Flabellammina clava Alexander & Smith and Haplophragmium taylorense Cushman & Waters is shown to be present at, and limited to, several horizons within the Austin.

It is further shown that Planulina taylorensis (Carsey) is controlled by facies since it is found only in sections composed entirely of clay; whereas Citharina texana (Cushman) is controlled by time since it is present in beds assignable to the Austin group regardless of lithology.

The data are plotted on the stratigraphic grid previously established by Durham in order that the correspondence between the foraminiferal fauna and the stratigraphy can be discerned readily.

The various environments of deposition involved in the Austin sedimentation are interpreted by the fauna as ranging from littoral to deeper water off-shore and in a single instance to possible euxinic conditions.

An appendix containing maps and sections of the localities from which collections were made and the stratigraphic position of each sample and its faunal content is included in the dissertation.

Microfilm \$2.75; Xerox \$5.20. 101 pages.

**MISSISSIPPIAN GEODES OF
THE KEOKUK, IOWA, REGION.**

(Order No. 61-2958)

John Bernard Hayes, Ph.D.
The University of Wisconsin, 1961

Supervisor: Stanley A. Tyler

Diagenesis wrought many changes in mineralogically and chemically complex Keokuk, Warsaw and Salem marine sedimentary rocks (Mississippian) near Keokuk, Iowa. Most spectacular is development of abundant geodes and euhedra of at least sixteen minerals contained therein. The chalcedony shell of Keokuk and Warsaw geodes results from silica replacing calcite at the margins of early diagenetic calcareous concretions. The geode cavity results from acidic solution of the recrystallized calcite concretion core.

Distribution of concretions and, hence, geodes is controlled lithologically and stratigraphically. Concretions grew during early diagenesis in calcilutites of the Keokuk Formation and lower Warsaw member, and not in intimately associated biocalcarenites within those units. Growth occurred in plastic non-indurated sediments beneath the sea floor in an environment conducive to formation of pyrite and ferrous iron-bearing dolomite. Decaying organic matter in calcilutites produced anaerobic conditions of negative Eh, and locally raised the pH to the point where calcite precipitated in concretionary form.

Kaolinite in geode cavities formed during the same period of acid weathering which produced the geode cavity. Geode kaolinite is very well crystallized, approaching closely to ideal kaolinite. Kaolinite formed by constructional crystallization from decay products of illite and chlorite remaining after solution of the calcite concretion core.

Minerals occurring as euhedra and encrustations in geodes are: kaolinite, sphalerite, quartz, chalcedony, calcite, ankeritic protodolomite, aragonite, barite, goethite single crystals, pyrite, marcasite, millerite, chalcopyrite, malachite, smithsonite, selenite. They represent later events in geode history and were deposited under a variety of changing Eh and pH conditions. The thermodynamic principles of metamorphic differentiation provide a general explanation for concretionary growth and preferential formation of certain minerals in geode cavities.

Stratigraphic, mineralogic and petrologic studies of geode-bearing strata led to several conclusions. (1) The Mississippian sequence studied was deposited in a southward-retreating epicontinental sea, complete withdrawal being evidenced by an unconformity at the base of the St. Louis Formation. (2) Chlorite and kaolinite contents increase progressively with respect to illite in sediments deposited closer to shore. (3) All clay minerals studied are of detrital origin, adsorption of cations and anions being the major change undergone by clays in the marine environment. (4) A fossil soil zone with weathered chlorite and illite marks a local unconformity between lower and upper Warsaw members on the crest of the Warsaw Anticline. (5) Argillaceous Mg-rich calcilutites were dolomitized whereas intimately associated biocalcarenites remained calcitic, dolomitization having taken place during early diagenesis in a reducing environment beneath the sea floor. (6) Iron-bearing protodolomite is the rock-forming

mineral, as evidenced by detailed X-ray and chemical analyses. (7) Large-scale introduction of Mg from sources outside the calcilutes is unnecessary for protodolomite formation. (8) Migration and reprecipitation of silica to form chert and silica-rich areas in the rocks studied is a post-dolomitization, pre-lithification, pre-emergence and pre-acid weathering, early diagenetic process which probably operated while the sediments were beneath the sea floor.

Dolomitization, silicification, concretionary growth, geode development and mineral deposition in geode cavities represent attempts by the initially complex, unstable system of Mississippian sediments to attain the lowest possible total free energy under conditions of diagenesis.

Microfilm \$3.90; Xerox \$13.75. 303 pages.

**NORMAL PARAFFIN HYDROCARBONS
IN RECENT SEDIMENTS FROM
SAN FRANCISCO BAY, CALIFORNIA.**

(Order No. Mic 61-1024)

Keith Arthur Kvenvolden, Ph.D.
Stanford University, 1961

Post-Pleistocene sediments of San Francisco Bay, California, have been analyzed for the presence of normal paraffin hydrocarbons. Gas-liquid chromatography was used to examine sediment extracts for normal paraffins containing 8 through 13 carbon atoms per molecule (intermediate molecular weights). Liquid-solid chromatography, infrared and mass spectrometry were used to determine in sediment extracts normal paraffins containing more than 18 carbon atoms per molecule (high molecular weights). Knowledge of the normal paraffins in recent sediments may be useful in explaining the origin of crude oils, because crude oils contain normal paraffins in both intermediate and high molecular weight ranges.

The results of analyses of sediments of San Francisco Bay show that normal paraffins containing 8 through 13 carbon atoms are probably absent. If any one of these hydrocarbons is present, it must be present in a concentration less than one part per million dried sediment, for this concentration is the minimum limit of detection of the analytical procedure used. Normal paraffins containing more than 18 carbon atoms, however, were detected in these sediments. Concentrations from 3 to 6 parts per million dried sediment were determined for the total of all normal paraffins containing more than 18 carbon atoms per molecule. Among the normal paraffins containing 23 to 35 carbon atoms per molecule, the relative number of molecules containing an odd number of carbon atoms is greater than the relative number of molecules containing an even number of carbon atoms. This odd-carbon preference in normal paraffins of high molecular weights has been observed by other investigators in hydrocarbon extracts from recent sediments of many different environments.

When the normal paraffins found in the sediments of San Francisco Bay are compared with the normal paraffins found in crude oils, at least two differences are evident. (1) Normal paraffins of intermediate molecular weights are absent from the sediments or are present in very

small concentrations; however, these normal paraffins are common in crude oils. (2) Normal paraffins of high molecular weights are present in both the sediments and in crude oils. In the sediments the normal paraffins containing 23 to 35 carbon atoms per molecule show a predominance of odd-carbon-number molecules. In crude oils the normal paraffins in the same weight range are distributed so that odd-carbon-number molecules and even-carbon-number molecules are present in about equal amounts.

While the normal paraffins found in the sediments of San Francisco Bay do not as yet constitute part of a crude oil, these normal paraffins may contribute components to a future crude oil by undergoing changes so that the odd-carbon-number molecules are present in about the same proportions as the even-carbon-number molecules. In addition to form part of a future crude oil in the sediments, normal paraffins of intermediate molecular weights must be generated. Microfilm \$2.75; Xerox \$5.60. 111 pages.

**THE PLUTONIC AND METAMORPHIC ROCKS
OF BEN LOMOND MOUNTAIN,
SANTA CRUZ COUNTY, CALIFORNIA.**

(Order No. Mic 61-1028)

Gerhard William Leo, Ph.D.
Stanford University, 1961

Ben Lomond Mountain, situated in the California Coast Ranges northwest of the city of Santa Cruz, is underlain by a complex of plutonic and metamorphic rocks, evidently similar to those of other crystalline complexes in the Coast Ranges, that constitute an irregularly-shaped northwest trending mass with an exposed area of approximately fifty square miles. On its northeastern margin, the complex rises abruptly along the Ben Lomond fault; the southwestern boundary has a lobate pattern, defined by major stream canyons, indicating that the surface of the complex is relatively flat, with a gentle seaward dip.

The oldest rock in the area is granodiorite orthogneiss that crops out in two isolated bodies near the crest of the mountain. The relative age of this gneiss is based upon a sedimentary contact with schist. The remaining metamorphic rocks, comprising paragneisses, pelitic schists, quartzites, marbles, and local hornfelses, form several patches with a total area of about nine square miles. Calcite marble of various degrees of purity may be interbedded with schist, or may form isolated lenses up to one mile across; calc-silicate rocks in which calcite is subordinate or absent, are locally developed, notably near intrusive contacts. Chief among the non-carbonate minerals developed in marble are quartz, graphite, phlogopite, tremolite, clinopyroxene, and forsterite; less common are wollastonite, chondrodite, scapolite, and others. Wollastonite occurs in only one locality near a granitic contact, whereas elsewhere calcite and quartz are stable together. Chemical analyses of chondrodite and scapolite are presented, as well as X-ray and spectrographic analyses for these, and a number of other minerals and rocks.

The dominant metasedimentary rocks are quartzites, pelitic schists, and gneisses, the latter locally and moderately migmatized. Schists are characterized by

sillimanite, almandine-rich garnet, micas (mostly biotite), and potassium feldspar; cordierite is locally developed, but apparently only within about 700 feet of plutonic contacts. The nature and distribution of metamorphic mineral assemblages suggest deep-seated metamorphism under conditions corresponding to the boundary between the almandine amphibolite and hornblende hornfels facies, with local near-contact assemblages indicative of the pyroxene hornfels facies. Metamorphism is evidently related to the intrusion of the plutonic rocks, although available evidence does not allow a clear choice between, on the one hand, simple contact metamorphism, and, on the other, broad-scale regional metamorphism in which the intrusion of plutonic rocks represents the culminating phase. In accordance with recent potassium-argon age determinations of some granitic rocks of the Coast Ranges (82-92 m.y.), intrusion and metamorphism can probably be correlated with the Upper Cretaceous Santa Lucian orogeny.

The principal plutonic rock type is a medium-grained hornblende-biotite quartz diorite which covers an estimated 25-30 square miles. Modal analyses of about forty specimens reveal much local variation, especially in the proportions of mafic constituents. Some contamination of the quartz diorite is indicated by local leucocratic masses, and by basic inclusions which may attain 60 feet in diameter. Other, much smaller, intrusive units are plugs of adamellite, granodiorite, and hornblende-cummingtonite gabbro; the latter rock is especially notable for certain peculiarities of structure and texture, as well as of mineralogy.

Analyses of gabbro, quartz diorite and adamellite show good agreement with variation diagrams of well-established calc-alkaline rock series; field and laboratory evidence point to a magmatic origin for these units, with a minimum of metasomatism or granitization. An analysis of aplite shows an abnormally high content of K₂O, and the latter may result from localized potash metasomatism, although such a rock could also be formed by differentiation under special conditions.

Microfilm \$2.75; Xerox \$8.80. 194 pages.

PENNSYLVANIAN STRATIGRAPHY OF SOUTHWESTERN WYOMING, NORTHWESTERN COLORADO, AND NORTHEASTERN UTAH.

(Order No. 61-2969)

Christian John Mann, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor L. R. Laudon

Paleontologic, lithologic, and stratigraphic features of Pennsylvanian strata in southwestern Wyoming, northwestern Colorado, and northeastern Utah have been investigated to determine more accurately the age and interrelationships of the various sedimentary facies, the depositional environment, the source of the sediments, and tectonic features existing during the Pennsylvanian Period.

Almost continuous deposition during the Pennsylvanian Period is recorded by strata throughout the area. The Darwin Sandstone of central Wyoming is the nearshore

facies of a black shale and limestone unit of northeastern Utah. Deposition of both units began in late Mississippian and continued across the systemic boundary into the early Pennsylvanian. These basal beds are conformably overlain by the Amsden and Morgan Formations that were deposited during the Morrowan, Atokan, and early Desmoinesian in a very stable shallow water marine environment. Both of these carbonate units are well dated by relatively abundant index fossils. They grade upward into neritic sandstones of the Tensleep and Weber formations of late Atokan, Desmoinesian, Missourian, Virgilian, and Wolfcampian age. The sandstones are not equivalent in age everywhere within the area studied. The Tensleep Sandstone includes beds of early Desmoinesian to Virgilian age in western Wyoming, but in central Wyoming only strata of late Atokan to late Desmoinesian age are present. The Weber Sandstone includes strata ranging from late Atokan to Wolfcampian age in the western Uinta Mountains and middle or late Desmoinesian to Wolfcampian age in western Colorado.

The Belden Shale of probable Morrowan and Atokan age, the Desmoinesian Minturn Formation, and the Maroon Formation of late Desmoinesian to Virgilian age are restricted to the Maroon Basin and adjacent areas in central Colorado. These units are equivalent to and interfinger westward with the Morgan Formation and Weber Sandstone.

The La Barge Platform of western Wyoming was a stable tectonic feature throughout the Pennsylvanian Period. The Uinta and Maroon Basins began slow subsidence in the Morrowan. Ancestral Front Range and Uncompahgre Mountains were rising, positive features from Desmoinesian until the Permian and an incipient Great Divide Basin was formed during the Desmoinesian. The Wyoming Arch has existed since late Desmoinesian and is an extension of the Ancestral Front Range. No evidence has been found to indicate that the Green River Basin existed during the late Paleozoic.

The main source of the clastic material deposited in the area during the Pennsylvanian is unknown. The sediments appear to have come from the north and east. The probable source is either the cratonic area or the Ancestral Rocky Mountains. A southeastern Wyoming source area was apparently important during deposition of the Darwin Sandstone. The Ancestral Front Range and Uncompahgre Range supplied coarse clastic material locally to the Maroon Basin and areas bordering the late Pennsylvanian uplifts. Microfilm \$2.75; Xerox \$6.40. 132 pages.

A SYSTEMATIC STUDY OF THE GASTROPOD FAMILY RISSOINIDAE

(Order No. Mic 61-1030)

Priscilla Juan Militante, Ph.D.
Stanford University, 1961

The ultimate goal of this study is to make use of the specimens of the group in stratigraphic interpretation of sediments, especially in Philippine Tertiary formations, and to facilitate future work on Recent forms.

The Family Rissoinidae is represented by small herbivorous marine gastropods with a shell height range of approximately 2 to 25 mm. The average is about 5 to 6 mm. The animals thrive well in warmer seas, especially

in the Indo-Pacific and West Indies. The fossil record dates from Mesozoic to Recent in deposits of the Paris Basin, North America, West Indies, Japan, East Indies, Australia, and New Zealand.

The shells are mostly high turreted, with pointed spires and delicately sculptured whorls. The aperture is produced anteriorly and in most cases made more distinct by the breaking through of a short columellar sinus. The characteristically chitinous paucispiral operculum is provided with a finger-like projection from the inner side of the excentric, almost marginal nucleus.

The relationship of the rissoinids to the other members of the prosobranchiate and taenioglossate Superfamily Rissoacea is shown in the central plate of the radula, the operculum, and the position of the eyes. The family is differentiated from the related Rissoidae by the presence of the opercular projection, the form of the aperture, and the more tropical distribution.

Since d'Orbigny recognized and separated Rissoina from Rissoa in 1840, many generic names have been proposed for the group. Of the 58 names recorded, 6 are synonyms and 12 are presently considered inappropriate. Chief sources of information used in this study are The Zoological Record from 1864 to 1956; Cossmann, 1919 and 1921; and Laseron, 1956.

The eight main groups of genera recognized in the Rissoinidae are here given subfamily status — Rissoininae, Schwartziellinae, Rissolininae, Pseudotaphrinae, Zebinellinae, Phosinellinae, Moerchiellinae and Zebininae. The classification is a modification of Schwartz von Mohrenstern's grouping and Nevill's sections and subgenera of Rissoina. A new genus Zebinopsis of the new Subfamily Zebininae is also here proposed; a new name Rissoinita for Iselia Weinkauff, 1881 here given; and a type species for Chiliostigma Melvill, 1918 here designated.

The characters selected as criteria for grouping and identification of specimens on the generic and subgeneric levels were tested for validity on a large amount of Recent material from the Philippines, the bulk of which forms the collections from the dredgings of the U. S. Bureau of Fisheries' Steamer Albatross, in Philippine seas (1907 to 1910). A graphical analysis also was made of rissoinid distribution in Philippine waters by region, depth, and sediment types. All the subfamilies were represented in the collections except Pseudotaphrinae. The genera Rissolina and Phintorene predominate in probable number of species and number of individuals present. Also significant are Austrosina and Zebina.

Some species of Rissolina thrive well in deep waters as much as 375 fathoms. Several specimens were found with operculum and radula intact. Animals probably lived on detritus rather than algae in those deep areas.

The Albatross material alone would not give a true picture of rissoinid distribution in the Philippines. It must be supplemented with more specimens from adjacent shallow waters of the area.

The gastropod Family Rissoinidae is only one of the several families of Recent and fossil small mollusks that are in great need of study. It is not so significant, then, which group is chosen for investigation as it is to take a step in laying a foundation for future researches in other molluscan groups. There are other aspects that need to be explored even in the Rissoinidae such as comparative ecology, life histories and the morphology and habits of the animal itself. This present study is therefore only a

part of a series of studies that have to be made on sub-microscopic Recent and fossil forms.

Microfilm \$2.75; Xerox \$4.60. 89 pages.

GEOLOGY OF THE PONCE-COAMO AREA, PUERTO RICO.

(Order No. Mic 61-1999)

Emile Anthony Pessagno, Jr., Ph.D.
Princeton University, 1960

The Ponce-Coamo area includes about 400 square miles in south-central Puerto Rico. The rocks are divided into a deformed sequence of folded, faulted, intruded, but unmetamorphosed rocks and an undeformed sequence of relatively flat-lying rocks. The deformed sequence in this area includes rocks of Cenomanian to early middle Eocene age. It can be divided into 7 formation units: (1) the Robles formation (Cenomanian-Turonian); (2) the Ildefonso formation (Upper Santonian to Lower Campanian); (3) the Toa Vaca formation (Upper Santonian to Lower Campanian); (4) the Río Blanco formation (Lower Maestrichtian); (5) the Río Yauco formation (Lower Maestrichtian); (6) the Naranjo formation (Lower Middle Eocene); and (7) the Augustinillo formation (Lower Middle Eocene). The latter two formations are included in the Eocene Jacaguas group. There are two unconformities within the deformed sequence. One is a disconformity separating the rocks of the Ildefonso and Toa Vaca formations from those of the underlying Robles formation and the other is an angular unconformity separating the former formations from the overlying Jacaguas group. A regional angular unconformity exists between the rocks of the deformed sequence and the rocks of the undeformed sequence. The undeformed sequence consists of rocks of late middle Oligocene to Recent age.

Structurally, the Ponce-Coamo area lies on the southern flank of the large anticlinorium that forms the backbone of the island. Rocks here generally trend to the northwest; however, two periods of deformation have given them a complex structural pattern. The early Maestrichtian disturbance, which is known in southwestern Puerto Rico apparently also affected the rocks of the Ponce-Coamo area. A more intense regional orogeny occurred between early middle Eocene and late middle Oligocene times. The most striking structural feature in this area is a large reverse (?) fault, the Cerrillos-Descalabrado fault, which strikes roughly N60W across the area and probably can be traced to the west coast. Rocks of Cenomanian to early Maestrichtian age have been brought into contact with rocks of early middle Eocene age along this fault. Near Ponce a microbreccia zone approximately 600 feet thick is developed.

Intrusive igneous rocks in the Ponce-Coamo area are listed below:

- (1) Anón andesite. Hornblende andesite. Post early middle Eocene-?pre-late middle Oligocene;
- (2) Tibes diorite. Gabbro diorite. Post early Maestrichtian-?pre-late middle Eocene.
- (3) Pasto andesite. Hornblende andesite. Post early Campanian-?pre-early middle Eocene.

Microfilm \$2.75; Xerox \$7.80. 170 pages.

DACITIC ASH-FLOW SHEET
NEAR SUPERIOR AND GLOBE, ARIZONA.

(Order No. Mic 61-1034)

Donald William Peterson, Ph.D.
Stanford University, 1961

Remnants of a dacitic ash-flow sheet near Globe, Miami, and Superior, Arizona cover about 100 square miles; before erosion the area covered by the sheet was at least 400 square miles and perhaps as much as 1,500 square miles. Its maximum thickness is about 2,000 feet, its average thickness is about 500 feet, and its original volume was at least 40 cubic miles. It was erupted on an eroded surface with considerable relief.

The main part of the deposit was thought by early workers to be a lava flow. Even after the distinctive character of welded tuffs and related rocks was discovered, the nature and origin of this deposit remained dubious because textures did not correspond to those in other welded tuff bodies. Yet a lava flow as silicic as this dacite would be viscous instead of spreading out as an extensive sheet. The purpose of this investigation has been to study the deposit, resolve the inconsistencies, and deduce its origin and history.

Five stratigraphic zones are distinguished according to differences in the groundmass. From bottom to top the zones are basal tuff, vitrophyre, brown zone, gray zone, and white zone. The three upper zones are distinguished by colors on fresh surfaces, for each weathers to a similar shade of light reddish brown. Nonwelded basal tuff grades upward into the vitrophyre, which is a highly welded tuff. The brown and gray zones consist of highly welded tuff with a lithoidal groundmass. Degree of welding decreases progressively upward through the gray and the white zones, and the upper white zone is nonwelded. Textures are clearly outlined in the lower part of the brown zone, but upward they become more diffuse because of increasing devitrification. In the white zone, original textures are essentially obliterated, and the groundmass consists of spherulites and microcrystalline intergrowths. The chief groundmass minerals are cristobalite and sanidine, with lesser quartz and plagioclase. Phenocrysts comprise about 40 percent of the rock, and their relative proportions are fairly uniform. Almost three-fourths of the phenocrysts are plagioclase, one-tenth quartz, one-tenth biotite, and the remainder sanidine, magnetite, and hornblende, with accessory sphene, zircon, and apatite.

Pumice fragments are nearly equidimensional near the top of the sheet, and downward they become progressively more flattened until they finally disappear. The zones and the pumice fragment flattening ratio (ratio of length to height) provide means for recognizing several faults within the sheet.

Twelve new chemical analyses are nearly uniform in composition. If named according to chemical composition, the rock would be a quartz latite, but when named according to phenocrysts, it is a dacite.

From the field occurrence and the interpretation of relict textures, it is concluded that the deposit is an ash-flow sheet containing large amounts of welded tuff, and that it was emplaced by a type of nuée ardente instead of a lava flow or air-fall shower. The nature of zoning and trend of flattening ratios indicate a series of eruptions in

rapid enough succession for the sheet to form a single cooling unit. Except in the lower part of the sheet, original textures were obscured by devitrification and crystallization during cooling. Nearly uniform mineralogy and chemistry suggest a single magmatic source. A nearly circular area, about $3\frac{1}{2}$ miles in diameter, of altered dacite and earlier volcanic rocks, bounded by intricately faulted and brecciated older rocks, may be the site of a caldera that represents the source of the eruption.

Microfilm \$2.75; Xerox \$8.20. 178 pages.

OSTRACODS OF THE FAMILY QUASILLITIDAE
FROM THE MIDDLE DEVONIAN STRATA
OF MICHIGAN, OHIO, NEW YORK
AND ONTARIO.

(Order No. Mic 61-2784)

Rex Marion Peterson, Ph.D.
University of Michigan, 1961

The Middle Devonian formations of Michigan, Ohio, New York, and Ontario contain many genera and species of the ostracod family Quasillitidae.

Material for this investigation is from Hamilton sections of five areas: (1) the northern part of the Southern Peninsula of Michigan; (2) near Silica, Lucas County, Ohio; (3) near Sandusky, Erie County, Ohio; (4) the western half of New York state; and (5) Middlesex and Lambton Counties, Ontario. Rocks of the same age from central and southern Indiana contain no quasillitid ostracods.

Ostracods of this family were studied in regard to their regional, stratigraphic, and evolutionary relationships. Included in the study are 10 genera, 50 species, and 15 subspecies, of which 14 species and five subspecies are new. Previously described species were reexamined and, where necessary, redefined, and the evolutionary history of related groups of species was traced. Seventeen species and two genera (Lucasella Stewart, 1936, p. 761, and Spinovina Coryell and Malkin, 1936, p. 17) are considered to be synonyms. Middle Devonian specimens formerly assigned to the genus Burlella Coryell and Booth (1933, p. 268) are here assigned to the genus Quasillites. The known geographic range of many species is extended. The family Quasillitidae should be useful for local and regional correlations, especially in subsurface work.

The stratigraphic correlations based on Quasillitidae agree with those of Cooper et al. (1942) with the exception that, according to quasillitid ostracods, the "Upper Blue" shale of the Gravel Point formation appears to be of the same age as the Dock Street clay member of the Four Mile Dam formation.

The new taxa are generically distributed as follows: three species and two subspecies of Euglyphella; four species and two subspecies of Quasillites; one species and one subspecies of Jenningsina; two species each of Janetina and Parabufina; and one species each of Bufina and Ropolonellus.

Microfilm \$2.75; Xerox \$8.80. 193 pages.

**MATHEMATICAL METHODS IN
THE INTERPRETATION OF MAGNETIC DATA**

(Order No. 61-2979)

P. V. Sanker-Narayan, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor George P. Woollard

The dissertation study is presented in three parts of which Part One is a critical review of the mathematical methods used in the interpretation of magnetic data. The various techniques which come under the two broad groupings, Pole and Line Theory and Induction Theory are discussed, starting with the basic theory, the physical assumptions involved, the mode of application and a discussion of the results, pointing out the specific advantages and limitations of each method as compared with the rest. The section is concluded by a discussion on two interesting aspects of work done by the author: (a) the use of broad, regional anomalies in studies of deep crustal structure; and (b) exponential relations observed in the amplitudes of arrays of anomalies.

Part Two presents a fairly extensive treatment on the preparation, properties, uses and limitations of high resolution anomaly maps. A comparative study of the various methods and controlling parameters is given, using for illustration, an anomalous belt around Madison, Wisconsin.

Part Three is devoted to a reconnaissance aeromagnetic survey of Wisconsin State carried out as part of the dissertation study using a Proton Precession magnetometer. The theory and description of the instrument, the details of observational and reduction procedure and a discussion of the factors influencing the accuracy of observations are included in this section. An absolute total intensity aeromagnetic map of southern Wisconsin (south of latitude $43^{\circ} 45'$) compiled from the survey is presented together with a companion second derivative map and a map of the derived basement configuration. A brief analysis of some of the major magnetic features depicted permits an objective appraisal of the geologic value of this type of study.

Microfilm \$3.15; Xerox \$11.05. 241 pages.

**STRATIGRAPHY AND ORIGIN OF
THE CHINLE FORMATION (UPPER TRIASSIC)
ON THE COLORADO PLATEAU**

(Order No. Mic 61-1040)

John Harris Stewart, Ph.D.
Stanford University, 1961

The Chinle formation of Late Triassic age consists of continental deposits of conglomerate, sandstone, siltstone, claystone, and limestone. It extends throughout most of the Colorado Plateau region, and ranges in thickness from 0 to 1700 feet.

Thin units or lenses of siltstone, and in some places sandstone and conglomerate, characterized by a peculiar mottling of red, purple, and gray occur directly below or in the basal few feet of the Chinle formation. The mottled strata are interpreted as remnants of a soil; the strata

are widely distributed along an unconformity at the base of the Chinle formation and have a coloration similar to some present day soils.

The Chinle formation is divided on a lithologic basis into two parts. The lower part extends over the southern part of the Colorado Plateau and into adjacent regions. It contains four main stratigraphic units or groups of units, (1) Shinarump and related members, (2) Monitor Butte and related members, (3) Moss Back member and related units, and (4) Petrified Forest member. The Shinarump and Moss Back members are thin widespread cross-stratified sandstone and conglomerate units that weather to form ledges. The Monitor Butte and Petrified Forest members are composed of variegated bentonitic slope-forming claystone, clayey siltstone, and clayey sandstone, and locally contain ledge-forming sandstone units.

The upper part of the Chinle formation extends throughout most of northeastern Arizona, northwestern New Mexico, eastern Utah, and western Colorado. It is divided into two parts, (1) Owl Rock member and (2) Church Rock member and related units. The Owl Rock member is composed of reddish-brown siltstone and thin beds of pale-red and light greenish-gray limestone. The Church Rock member is composed of reddish-brown siltstone and minor amounts of sandstone. The sandstone is commonly cross-stratified and is abundant in a narrow belt extending from southwestern Colorado to central Utah.

The fossils and sedimentary structures in the lower part of the Chinle formation indicate that it is a vast alluvial plain deposit. The thin widespread sandstone and conglomerate units, such as the Shinarump and Moss Back members, are probably braided stream deposits, for they are similar to deposits of present day braided streams. The claystone, clayey siltstone, and clayey sandstone of the Monitor Butte and Petrified Forest members, on the other hand, probably are deposits of large meandering streams and of lakes. Stream directions, as indicated by the orientation of cross-strata, are north to northwest. The source area of most of the material in the lower part of the formation, as indicated largely by stream directions, was in southern Arizona and adjacent states--the Mogollon highland. The type of detrital material in the lower part of the formation indicates that the Mogollon highland was predominantly a volcanic terrain and that it also contained cherty limestone or dolomite, sandstone, metasedimentary rocks, and probably granitic rocks.

The fossils and sedimentary structures in the upper part of the Chinle formation indicate that it is a large deltaic deposit spread out into a lake. The deposits of cross-stratified sandstone that extend in a narrow belt from southwestern Colorado to central Utah are probably the deposits of a large river which formed the delta. Stream directions in and near this narrow belt of fluvial sandstone are dominantly northwest. High igneous and metamorphic terrains in western Colorado and adjacent regions--the Uncompahgre and Front Range highlands--were the main source areas during deposition of the upper part of the formation.

Microfilm \$3.20. Xerox \$11.25. 247 pages.

GEOLOGY AND REGIONAL RELATIONSHIPS
OF THE SIERRA DEL FRAILE,
NUEVO LEÓN, MEXICO.

(Order No. Mic 61-2130)

James Ray Wall, Ph.D.
Louisiana State University, 1961

Supervisor: Dr. Grover E. Murray

The Sierra del Fraile, approximately fifteen miles northwest of Monterrey, Nuevo León, is one of a group of generally northwesterly aligned, anticlinal, mountain-forming folds which characterize the Coahuila Marginal Folded Province of northeastern Mexico. The marginal province, situated north and east of the Sierra Madre Oriental, on the southwestern flank of the Rio Grande Embayment, includes the Parras and Sabinas sedimentary basins and part of the paleotectonic Coahuila Platform.

The stratigraphic section exposed in and adjacent to the Sierra del Fraile includes several thousand feet of evaporitic deposits of uncertain (Permian-Jurassic) age; Upper Jurassic (Sabinasian) limestones and shales, approximately 3000 feet thick; and Cretaceous (Coahuilan to Gulfian) limestones, shales, and sandstones, with a maximum thickness of approximately 25,000 feet.

The Sierra is formed by two breached and extensively eroded, doubly plunging anticlines, partially separated by similarly plunging segments of a synclinal fold whose axes are generally aligned concordantly with those of the anticlines. Topographic highs within the eroded valleys are formed by axial ridges of Jurassic limestone and by chaotic masses of Lower Cretaceous rocks which have slumped into the interior.

The presence of intrusive gypsum in the northern anticline suggests that evaporitic deposits have contributed to structural development of the Sierra del Fraile and other anticlinal structures of the Coahuila Marginal Folded Province. The relative importance or effectiveness of tectonic (compressional) forces and gravity or density controlled movements cannot be assessed, but the sharply deformed nature of the folds, and their location marginal to the intensely deformed Sierra Madre Oriental, suggest that tectonic forces provided the primary motivating force for upward movement of the salts. The conclusion is drawn that thick evaporitic accumulations effected the position and shape of the marginal folds, but uplift is considered to have resulted from compressional forces, which are judged to be related to the Sierra Madre deformation and which may have been transmitted through incompetent beds into the basinal sediments.

Microfilm \$2.75; Xerox \$6.80. 142 pages.

GEOLOGY AND ORIGIN OF
THE POLLUCITE-BEARING MONTGARY
PEGMATITE, MANITOBA.

(Order No. 61-2990)

Charles Malcolm Wright, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Eugene Nathan Cameron

The Montgary pegmatite, located in the southeastern Manitoba pegmatite district, is a large, complexly zoned, spodumene-bearing body containing the world's largest known reserves of pollucite. One purpose of this investigation is to present a structural, mineralogical, paragenetical, and textural description of the pegmatite. A second purpose of the study is the development of an acceptable thesis of origin based on the study of the pegmatite and on a comprehensive investigation of the wall rocks.

The pegmatite, occurring near the margin of a granitic intrusive, forms a gently-inclined, elongated disc-shaped body lying more or less perpendicular to the near-vertical schistosity of a bounding, pre-Cambrian plagioclase-amphibolite. A quantitative, systematic study of the amphibolite has revealed no compositional or textural trends beyond a narrow alteration zone that can be correlated with distance from the pegmatite. The alteration zone, averaging between four and six feet wide, contains, in addition to the normal mineral assemblage of the amphibolite, small amounts of glaucophane, biotite, apatite, and tourmaline.

The pegmatite is subdivided into nine mineral assemblages comprising six zones, two definite replacement bodies and one tentative replacement body. The six zones are: (1) a quartz-albite border zone; (2) a perthite-quartz-plagioclase-muscovite wall zone; (3) a spodumene-perthite-plagioclase-quartz intermediate zone; (4) a spodumene-quartz, minor perthite intermediate zone; (5) a microcline-quartz intermediate zone, and (6) quartz core. Neglecting the quartz core and equating the two spodumene-bearing zones, the internal structure is one of concentric shells. Aplitic albite replaces lower portions of the spodumene-bearing zones and upper portions of the footwall wall zone. Very fine-grained lepidolite pseudomorphs parts of the microcline-quartz zone. Pollucite, forming very fine-grained, monomineralic bodies cut by veins of quartz core, is tentatively regarded as a replacement body in the spodumene-quartz, minor perthite zone.

A quantitative analysis of the lithia distribution of the pegmatite reveals that lithia has been concentrated towards the hanging wall and up the dip of the pegmatite. The attitude of the pegmatite and the shape of the hanging wall amphibolite-pegmatite contact have exerted an important control over the lithia distribution during crystallization.

Metasomatism is rejected as a mechanism of the formation of this pegmatite due to a complete lack of relict structures, sharp amphibolite-pegmatite contacts, and the presence of angular rotated inclusions of amphibolite in the pegmatite.

Metamorphic differentiation is rejected as a mechanism active in the formation of the pegmatite because: (1) there is no detectable impoverishment of the amphibolite in pegmatitic constituents; (2) small quantities of K, B, P, F, and H₂O have been added from the pegmatite to the

amphibolite; (3) concretionary growth is inconsistent with the lack of structural disturbances associated with pegmatite emplacement and is inconsistent with the inward growth direction of the pegmatite deduced from the shape and orientation of some tourmaline and beryl crystals; (4) secretory growth offers no apparent explanation of the asymmetrical internal structure, and (5) secretory and concretionary growth are mutually incompatible in accounting for the normal zonal sequence found in pegmatites.

An igneous hypothesis of origin is the most acceptable. Pegmatitic fluids, probably related to the nearby granitic intrusive, were permissively introduced into a dilatant zone along a sinuous shear. The internal structure is consistent with fractional crystallization accompanied by resurgent boiling of the residual liquid in a restricted system

with deposition of crystals taking place from the walls inward. The zonal structure has been influenced, but not caused, by the attitude of the pegmatite. Upward lithia concentration is consistent with the development of a second fluid phase by resurgent boiling following the deposition of wall zone material. The presence of this second fluid phase would allow rapid and selective diffusion of lithium upward. Alkali replacement bodies were emplaced late in the history of the pegmatite. The fluids responsible for their formation were probably generated within the pegmatite either from vapors formed by resurgent boiling or were residual fluids left over after the main pegmatite crystallization.

Microfilm \$2.75; Xerox \$5.60. 111 pages.

HEALTH SCIENCES

HEALTH SCIENCES, PATHOLOGY

THE ROLE OF "TOXIC FAT" IN THE PRODUCTION OF HYDROPERICARDIUM AND ASCITES

(Order No. 61-2939)

James Rex Allen Jr., Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Joseph J. Lalich

"Toxic fat" is the name applied to certain distilled animal fats whose residue, when added to the diet of chickens produces hydropericardium and ascites. The chemical nature of the toxic factor is unknown, although it has been shown to be located in the nonsaponifiable fraction of the fat and has recently been isolated in a crystalline form.

In the investigation of the mechanism by which "toxic fat" produces ascites and edema, a number of experiments were conducted. In the initial trial, levels ranging from 0.5 to 5.0 percent "toxic fat" were added to the diet of young chicks for 35 days. There was a reduction in growth rate resulting from the consumption of the fat. Hydropericardium and ascites were found in all animals receiving from 1.0 to 5.0 percent "toxic fat." The total blood proteins, albumin-globulin ratios, and non-protein nitrogen levels were not altered by the consumption of the fat; therefore, excessive extravascular fluid was not attributed to hepatic or renal injury and associated protein changes. Experiments conducted to determine the effects of "toxic fat" on mice, pigeons and turkeys demonstrated a reduction in growth without hydropericardium and ascites.

Microscopic examination of the tissues of the test animals revealed lymphocytic foci in the epicardium and myocardium. Edematous fluid separated the myocardial fibers. Edema of the lungs was a frequent observation in the experimental birds. There was moderate fatty infiltration of the liver plus some lymphoid and myeloid hyperplasia.

It was found that the total white and red blood cell count, differential white count, hematocrit levels, prothrombin times, clotting times, hemoglobin levels, and thrombocyte counts were not altered appreciably by the consumption of "toxic fat."

One percent silver nitrate perfusion of the thoracic aorta in chickens was found to be applicable for studying alterations in the mesenteric capillaries. "Toxic fat" fed chickens had irregularly outlined cement substance between the endothelial cells and more extravascular silver in the surrounding tissue. Blood pressure studies indicated the test birds had an elevated average mean pressure in the right ventricle of 6 cm. water and 2 cm. water in the vena cava. Electron micrographs of the myocardium revealed shrunken, vacuolated mitochondria in the test animals.

Concentrations of 0.25 to 1.0 percent "toxic fat" in the diet for 150 days were associated with no appreciable difference in the growth rate. There was observed a marked reduction in testicular weights of the test animals due to a reduction in size of the seminiferous tubules and an inhibition of spermatogenesis.

"Toxic fat" produces a reduction in growth rate of experimental animals. This reduction depends on the age of the animal and the level of "toxic fat" added to the diet. Hydropericardium and ascites were a frequent lesion in the animals receiving from 1.0 to 5.0 percent "toxic fat." When this level was reduced to 0.25 percent in the diet, reduced testicular development was a more sensitive criterion than hydropericardium, ascites, or weight gain for evaluating chronic toxicity.

The mechanism by which "toxic fat" induces hydropericardium and ascites appears to be associated with degeneration and edema of the myocardial fibers. These data would tend to eliminate the kidneys, liver, and endocrines as the primary cause of the edema. The early development of hydropericardium, increased venous pressure, enlarged hearts, mitochondrial changes in the myocardium and generalized edema suggest that the myocardium may be directly inhibited; however, altered capillary permeability has not been excluded. It is believed that cardiac compensation and increased capillary permeability act together

in producing the excessive extravascular fluid collection and the demise of the animal.

Microfilm \$2.75; Xerox \$5.20. 103 pages.

EXPERIMENTAL RIFT VALLEY FEVER

(Order No. 61-2949)

Bernard Carlyle Easterday, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Robert P. Hanson

A study of Rift Valley fever was undertaken to determine the susceptibility of a sample of United States livestock and to gain information that would assist in the rapid recognition of this disease if it should gain entrance into the United States.

The character and course of the disease in a sample of livestock and laboratory animals was described with special reference to the development, level, and duration of viremia in relation to the development, degree, and duration of febrile response, blood changes, lesions, and clinical signs.

The general aspects of the disease in the species studied were similar to those that have been described and reported by others previously. An attempt was made to define the minimum amount of virus necessary to infect those species studied (sheep, goats, cattle, monkeys, mice, hamsters). The effect of age on the susceptibility of sheep was described. The disease in calves (bovine) appeared to be more severe and result in a higher mortality rate than had previously been reported. The susceptibility of calves was similar to that of lambs. The levels of virus in the blood of calves and goats were not as high as those in lambs of a similar age. The course of the disease in goats was not as predictable as in lambs.

The study of the disease in monkeys did not provide sufficient information to substantiate or deny that the disease in monkeys was similar to the disease in man.

Lambs, monkeys, hamsters, and mice were infected when exposed to aerosols of Rift Valley fever virus, but the disease was not transmitted by contact in lambs and mice.

Two species of mosquitoes (*Aedes aegypti* and *Aedes triseriatus*) that are present in the United States were shown to be capable of transmitting Rift Valley fever virus from lamb to lamb.

The susceptibility of hamsters to this virus was similar to that of mice. Either of these species may be employed for the isolation and assay of this virus.

Six cell or tissue culture systems were shown to be capable of supporting the growth of this virus. Infected cell cultures were detected with fluorescent antibody staining. Microfilm \$2.75; Xerox \$9.00. 197 pages.

STUDIES OF SOME MORPHOLOGIC PROPERTIES AND HORMONAL ACTIVITIES OF A SUSPENSION OF INTACT SINGLE CELLS DERIVED FROM THE ANTERIOR HYPOPHYSIS OF THE ADULT MALE RAT

(Order No. Mic 61-2165)

Griff Terry Ross, M.D., Ph.D.
University of Minnesota, 1961

Serious limitations result from the preparation of pituitary cells for quantitative cytologic studies by traditional methods of fixation, imbedding in paraffin and sectioning. The study of some unsolved problems of hypophyseal cytology would be facilitated if it were possible to produce homogeneous suspensions of single, intact, morphologically normal cells of the anterior pituitary gland.

Using traditional chemical, enzymatic and mechanical methods, unsuccessful attempts were made to produce suspensions from fresh and partially autolyzed pituitary glands of adult male rats. Factors which appeared to limit the production of ideal suspensions by these methods appeared to be extreme fragility, cohesiveness, and susceptibility of the cells to intracellular autolysis.

For the study of conditions influencing these limiting factors, methods were developed for producing, fixing, and staining imprints of the anterior pituitary glands of adult male rats. On the basis of studies made on imprints, a method was devised for incubating fresh anterior pituitary glands in a small closed chamber containing acetic acid. Following incubation, intracellular autolysis was inhibited while the fragility and cohesiveness of the cells appeared to be reduced. It was then possible to produce a suspension of intact single cells by mechanical methods.

Cells in smears of the suspension fixed and stained by traditional methods showed no remarkable alterations in tinctorial properties. The yield of intact single cells appeared to be adequate to permit the determination of approximate values for such parameters as geometric mean cross sectional area, mean wet cell mass, and mean cell protein content.

The cells in suspension were found by bioassay to retain the major proportion of the activities of whole suspensions with respect to Adrenocorticotrophic Hormone (ACTH), Melanocyte Stimulating Hormone (MSH), Growth Hormone (STH), Prolactin and Follicle Stimulating Hormone (FSH). Minimal amounts of Luteinizing Hormone (LH) but no Thyroid Stimulating Hormone (TSH) activity could be demonstrated in cells in suspension by methods used at doses tested. Approximate minimal effective doses of the cellular fraction for the demonstration of the activities of the hormones in suspensions of cells of the anterior hypophyses of intact adult male rats were determined for the assays used.

Microfilm \$2.75; Xerox \$7.00. 146 pages.

HEALTH SCIENCES, PHARMACY

**THE REQUIREMENTS FOR SUCCESS
AMONG PERSONNEL IN TWO DIVISIONS
OF THE PHARMACEUTICAL INDUSTRY:
A COMPARATIVE ANALYSIS AND EVALUATION
OF THE FACTORS CONTRIBUTING TO
SUCCESS IN THE SALES AND RESEARCH
AREAS OF INDUSTRIAL
PHARMACEUTICAL MANUFACTURING.**

(Order No. Mic 61-312)

Leonard T. Chavkin, Ph.D.
Joseph Louis Kanig, Ph.D.
New York University, 1960

The purpose of this study was to discover those attributes which make for success in pharmaceutical sales and research and to relate these to the guidance, selection, training and evaluation of these personnel by colleges of pharmacy and pharmaceutical manufacturing companies. No well accepted methods currently exist that will perform these functions in an objective manner. The need is particularly acute since, next to retail pharmacy practice, these two occupations attract the greatest number of pharmacy college graduates. Recent trends indicate that increasing numbers of pharmacists are entering these occupations, primarily due to the expansion of the pharmaceutical industry.

By September, 1960 all of the pharmacy colleges in this country will have expanded the undergraduate curriculum to five years. Many schools will include elective courses or programs of preparation for pharmaceutical sales and research. The problem of guidance of students into these programs will become serious.

The first stage in this study involved the determination of the types of attributes that make for success in these occupations. By the use of the Critical Incident Technique descriptions were obtained from sales and research supervisors of actual occurrences that involved men under their jurisdiction and contributed directly to their success or failure. Fifty-two sales and thirty-five research supervisors were interviewed from among the major pharmaceutical companies. A total of 670 useful incidents were collected relating to sales personnel and 314 for research workers.

These incidents were categorized on the basis of the types of behavior involved and offered a description of the critical attributes that describe the successful Medical Service Representative and Pharmaceutical Research Worker. In addition, it was possible to assign a relative importance to each type of behavior based upon the number of times it was mentioned by supervisors as being critical to success.

Based upon these data rating checklists were constructed for evaluating the performance of sales and research personnel on the job, and weights were assigned to each section of the checklists based upon the relative importance of the particular attribute.

The validities of the checklists were determined against supervisors' rankings and found to be .71 for sales and .73 for research. The reliabilities of the checklists were found, by the test-retest method, to be .98 for sales and .95 for research.

Using rating checklist scores as criteria, the validity of a series of tests was determined using a test group comprised of 133 salesmen and 71 research workers. For sales, the following scales combined to give a validity coefficient of .34: Edwards - Exhibition; Allport-Vernon - Social; Strong - Accountant; and Strong - Real Estate Salesman. For research personnel, the following scales combined to provide a validity coefficient of .49: Edwards - Dominance; Allport-Vernon - Theoretical; Strong - Social Worker; and Strong - Occupational Level.

Colleges of pharmacy can use the results of this study as an aid in the counseling of prospective candidates for careers in sales and research. Achievement on the recommended test battery is an indication of success potential in these occupations. In addition, the lists of critical behaviors can serve as a guide in developing course work in programs designed to prepare pharmacists for these jobs.

Industrial pharmaceutical concerns can benefit from the use of the recommended test batteries as aids in the selection of candidates for sales and research positions. The lists of critical behaviors can add value to the training programs offered by these companies. The rating checklists will serve as valid means for the evaluation of the on-the-job performance of sales and research personnel and can aid the supervisors, Personnel Departments, and the workers themselves in understanding the good points and the shortcomings of the personnel currently employed.

Microfilm \$3.35; Xerox \$11.70. 257 pages.

**THE INTERACTIONS OF
XANTHINE MOLECULES WITH
BOVINE SERUM ALBUMIN**

(Order No. Mic 61-2826)

Martin Leonard Eichman, Ph.D.
The Ohio State University, 1961

This study was concerned with the reversible associations of a number of structurally related xanthine derivatives with bovine serum albumin. Interactions with plasma proteins are considered to be important factors in determining the distribution, stability, duration, and activity of a drug in the body. This study was conducted to obtain a more fundamental understanding of binding phenomena and, more specifically, to determine some of the structural specificities involved in the interaction of xanthine molecules with bovine serum albumin. Through equilibrium dialysis studies conducted at pH 6.85 in P_2O_{16} phosphate buffer, it was shown that the interactive tendencies of caffeine (1,3,7-trimethylxantine) and theophylline (1,3-dimethylxanthine) were quantitatively similar, whereas only slight binding occurred with theobromine (3,7-dimethylxanthine), uracil, and 1,3-dimethyluracil. From this, it was concluded that the fused ring system and substitution at the 1 position were required for significant interaction to occur. Eight-substituted derivatives of caffeine exhibited a markedly greater degree of interaction than caffeine. The substituent effect decreased in the order $\text{OCH}_3 > \text{Cl} > \text{OCH}_2\text{CH}_3 > \text{CH}_3 > \text{H}$. The results indicated that caffeine and its 8-substituted derivatives were bound primarily at one site on each albumin molecule. A low degree of binding at secondary sites was also observed.

The interaction of caffeine was pH dependent. A slight decrease in binding was observed as the pH was raised from 4.7 to 8.5. At higher pH values a more marked decline in the association occurred. The latter effect was attributed to the release of a proton from a cationic ϵ amino group on the protein.

Anionic species were generally found to possess a greater interactive tendency than those which had no formal charge. This was reflected in both larger primary and secondary interactions. Association constants for the binding of 8-chlorotheophylline, 8-nitrotheophylline, theophylline-7-acetic acid, and 1,3,7-trimethyluric acid were evaluated with the assumption that two classes of sites on the protein, containing one and two groupings respectively, were involved. Binding curves calculated on this basis agreed well with the experimental data. Eight-chlorotheophylline and 8-nitrotheophylline were found to possess interactive tendencies which were greater than any of the other compounds studied. The presence of a negative charge on the oxygen atom attached to the number six carbon was considered to be significant. The participation of this oxygen in the formation of the complex was strongly indicated.

The effect of pH on the binding behavior of 8-nitrotheophylline was similar to that with caffeine. In contrast, a marked increase was noted in the association of 8-chlorotheophylline as the pH was raised from 4.7 to 6.5. A similar effect occurred with theophylline in the pH region of 7 to 8.5. The increased binding paralleled an increase in the degree of ionization of the compounds and further indicated that the ionic species were bound more strongly than the corresponding non-ionic forms. As with caffeine and 8-nitrotheophylline, the interactions of theophylline and 8-chlorotheophylline decreased at pH values above 8.5. The diminished degree of binding at pH values above 8.5 implicated the participation of an amino group on the protein. Additional support for this hypothesis was obtained from competition studies. Thus, the binding of 8-nitrotheophylline was inhibited in the presence of salicylate, sulfisoxazole, and thiocyanate. Since these compounds have been shown to bind at sites involving ϵ amino groups on the protein, their inhibitory effect indicated that 8-nitrotheophylline was bound at a similar site.

Studies conducted at 0° C., 9° C. and 30° C. showed the interaction of 8-nitrotheophylline to decrease as the temperature was raised. ΔH° was equal to - 5070 cal. mole⁻¹ and ΔS°_{25} was equal to 6.4 cal. deg.⁻¹ mole⁻¹. Both of these terms therefore contributed energetically to the complex formation.

The interaction of 8-nitrotheophylline with human plasma was shown to be quantitatively and qualitatively similar to that with bovine serum albumin. On this basis it appears that 8-nitrotheophylline and other xanthine molecules can be expected to associate *in vivo* with human plasma proteins.

Microfilm \$2.75; Xerox \$5.20. 103 pages.

A STUDY OF THE CATIONIC EXCHANGE PROPERTIES OF ACID-ACTIVATED BENTONITE

(Order No. Mic 61-2848)

Earl William Seugling, Jr., Ph.D.
The Ohio State University, 1961

Acid activated bentonite has been shown to exhibit cation exchange properties. This investigation was undertaken to further investigate these properties with the purpose of establishing the existence and extent of adsorption and exchange. Acid activated bentonite was prepared to meet the following condition: saturation of exchange sites with hydrogen ions. This would allow a means of determining the extent of exchange; the pH of the equilibrium solution would remain constant when the exchange sites are filled.

In order to test structural variation effects on exchange and adsorption, a series of B-phenylethylamines was selected; viz., those with phenolic hydroxyl substitution; those with increasing alkylation of the amino group, but without phenolic hydroxyl substitution; and those with nohydroxyl substitution. Silicic acid produced by acid activation of bentonite absorbs in the ultraviolet range in which the amines exhibit maximum absorption; therefore, a modified spectrophotometric assay was developed to determine the amount of amine present in the equilibrium solution in the presence of irrelevant interfering absorption. The extent of exchange was determined by assaying the equilibrium solution. The exchange capacity, as indicated by constant pH of the equilibrium solution, was determined for the amine series, and it was less than that normally reported for bentonite, which indicates the occurrence of adsorption. The sorption isotherms were determined for the amine series; the amines within each group exhibit similar isotherms. The sorption isotherms also indicate that exchange and adsorption occur simultaneously; the exchange reaction predominates until the exchange sites are filled, then the adsorption reaction predominates. A relationship between the pK_b value of the amine and the extent of exchange was noted. Langmuir adsorption isotherms of the amine series results indicate that adsorption occurs, also. The results of the studies on the pH effect indicate that in the acidic range exchange predominates; whereas, adsorption predominates in the basic pH range.

A method of indicating the extent of exchange from the Langmuir isotherms at pH 2 and the normal pH of the amine solution was proposed. The values obtained by this method agree with those determined by the constant pH level of the equilibrium solution. The effect of the electrolyte cation and ionic strength on organic exchange reactions is not as drastic as that on inorganic reactions. Desorption of the amines from acid activated bentonite is possible. The amines with the highest pK_b values are the most easily desorbed, which substantiates the premise that the amines with the lower pK_b values will have the greater affinity for the exchange site.

Experimental verification of theoretical equations was performed. A two-component assay utilizing two amines with different exchange affinities was developed to test experimentally the theoretical equations. The equation proposed by Boyd *et al.* was the only equation, of those

tested, which gave good agreement. The Boyd equation in linear form is shown:

$$\frac{C_A/C_B}{(X/m)_A} = \frac{b_2}{b_1 k} + \frac{1}{k} \left(\frac{C_A}{C_B} \right);$$

therefore, a plot of $(C_A/D_B)/(X/m)_A$ versus C_A/C_B can be used to evaluate the constants.

Microfilm \$2.75; Xerox \$6.60. 136 pages.

THE KINETICS OF THIAMINE HYDROLYSIS

(Order No. 61-2989)

John Joseph Windheuser, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Takeru Higuchi

The kinetics of the hydrolytic cleavage of thiamine have been studied under anaerobic conditions at 96.4°C. The present contribution is concerned with the results of an investigation designed to establish the pH profile of this important reaction; to reconfirm the degradation products formed under the conditions of the experiments and to correlate them with the observed kinetic results; to determine whether agents other than hydrogen or hydroxyl ions can accelerate or inhibit the cleavage; and to establish its dependency on other kinetic variables.

Experimental results indicate that although subject to question in the past, the reaction exhibits a first order kinetic dependency in respect to thiamine when studied under controlled conditions. The specific first order rate constants for solutions varying over a 400 fold change in the initial concentration of the vitamin exhibited deviation from the mean of less than one per cent.

The pH - rate profile, essentially free of buffer effects, was found to be unusually complex. Analysis of the apparent slope of the curve over limited pH ranges indicated that the observed results could be attributed to a series of four separate reactions. The four reactions suggested were correlated with the degradation products as determined by paper chromatographic separation of samples degraded in a pH range 0.4 to 10.0 as follows:

- (1) Acid catalyzed cleavage of protonated thiamine yielding oxythiamine below pH 1.
- (2) Water cleavage of protonated thiamine in the pH range 1 - 6 yielding 2-methyl-4-amino-5-hydroxymethyl pyrimidine and 4-methyl-5β-hydroxyethyl thiazole.
- (3) Hydroxyl ion attack on protonated thiamine between pH 2 and 6.5 to form the same products as found in reaction (3).
- (4) Water cleavage of thiol thiamine at pH values above 6.5 resulting in the formation of 2-methyl-4-amino-5-aminomethyl pyrimidine and other compounds as yet undetermined.

Based on the above four reactions a kinetic rate expression was derived which, with the knowledge of the dissociation constants of the vitamin and four specific rate constants evaluated from experimental work, it was

possible to calculate a theoretical pH - rate profile which was in good agreement with the observed results. Although it would appear from the above that the series of four reactions adequately fit the data at hand, the possibility and perhaps the probability that the true situation may involve one or more substitute reactions is acknowledged. Kinetic analyses can readily eliminate many proposed reaction mechanisms, but they cannot establish the correct ones with absolute certainty.

Investigation of the effect of ionic strength variation on the hydrolytic rate suggested that, apparently due to the number of reactions involved in the over-all pH profile, the dependency varied from a zero to a negative effect.

The behavior of the hydrolysis in several buffer systems under conditions of varying buffer concentration at constant pH indicated that the reaction was subject to general base catalysis but not prone to attack by general acids in the pH range 1.5 to 8.0. In solutions of higher pH the reaction became refractive to general attack and even to hydroxyl ion. Because of the complexity of the interactions involving changes in both the thiamine species and those of the buffers, it was not possible as part of this study to clearly separate the reactions on the basis of reactive components.

Contrary to previously reported findings by others, it was found that amino acid species did not act as major positive or negative catalysts in respect to the hydrolytic reaction. Although marked stabilizing effects have been attributed to glycine and alanine, these results could not be confirmed under the conditions of the experiments and in fact these compounds exhibited slight catalytic properties.

Thermal coefficients of the observed rate of hydrolysis were determined at various pH values, each under conditions of constant pH. The results allowed estimation of the apparent activation energy for the four proposed reactions from the Arrhenius relationship and were found to be: reaction (1), 24 Kcal. mole; reaction (2), 29 Kcal. mole⁻¹; reaction (3), 25 Kcal. mole⁻¹; reaction (4), 21 Kcal. mole⁻¹.

Microfilm \$2.75; Xerox \$3.60. 61 pages.

HEALTH SCIENCES, PUBLIC HEALTH

THE BROOKLYN DAY HOSPITAL: AN EXPLORATORY STUDY.

(Order No. Mic 61-1069)

Becky Adelson, D.S.W.
Columbia University, 1961

The Brooklyn Day Hospital operates as part of the Brooklyn Aftercare Clinic on Fulton Street in downtown Brooklyn. The day hospital occupies 8,600 square feet of floor space divided into secretary's office; lounge, recreation, and lunch area; an occupational therapy unit consisting of offices, home shop, office shop, and industrial shop; library, and offices for personnel. It is staffed by two psychiatrists, two nurses, two occupational therapists, one social worker, one part-time vocational counselor, five attendants, two stenographers, and one maintenance man.

The chief objective of this study was to explore the nature and functions of the Brooklyn Day Hospital to learn

what factors were involved in the successful operation of the project and to suggest possible modifications to improve services. Two basic questions were considered: What were the results of treatment? How did the patients and their families perceive the effects of the day hospital program?

The basic method adopted for carrying out this inquiry was to conduct structured, "open-ended" interviews with patients and relatives, devising a code, tabulating the data, and analyzing the results. The 80 patients included in the study were schizophrenic, had previously been admitted to a state mental hospital, were between the ages of 18 and 50 years, and had attended the day hospital at least 5 days during the first calendar month following admission during the period of study (October 1, 1956, to October 1, 1957). Data were also secured from 60 relatives of these 80 patients.

The following conclusions are based on the data obtained during this study:

1. Patients with no occupation did not respond to treatment as well as those with an occupational status.
2. Patients living away from home responded to treatment better than patients living with family or relatives.
3. Patients attending the day hospital from 3 to 8 months responded better than those attending only 2 or 3 months.
4. Neither education nor marital status seemed to influence outcome of treatment.
5. There was no apparent relationship between length of previous hospitalization and outcome of day hospital treatment.
6. Nine-tenths of the patients had positive feelings about day hospital attendance, regardless of outcome of treatment.
7. Occupational therapy was the first choice of day hospital routines by both the much improved and the rehospitalized patients.
8. Recreation was a preferred social activity by both groups of patients.
9. Patients with a sudden onset of illness appear to have a better chance for a favorable outcome than those with an insidious onset.
10. Regularity of attendance appears to have a favorable effect upon outcome of treatment.
11. Patients in the much improved group chose typing nearly eight times as frequently as did patients in the rehospitalized group, and art was chosen more than twice as frequently by the rehospitalized patients as by the much improved patients.
12. Both groups of patients mentioned the nurse more frequently than any other staff member; the doctor was mentioned next often by both groups.
13. Rehospitalized patients found other patients friendly to a greater degree than did the much improved patients.
14. Both groups of patients felt they had acquired social attributes as a result of attendance.
15. Families of much improved patients reported greater change for the better in patient's responses to family members than did families of rehospitalized patients; this was also true for changes in leisure-time activities.
16. Patients in the much improved group had more realistic plans for the future than did rehospitalized patients.
17. Both groups of patients suggested that day hospital

services be extended to include evenings, week ends, and holidays.

This study likewise revealed areas in which services to patients might be extended or improved:

1. There were indications that additional casework for both patients and relatives was needed.
2. There is a need for a social club or association for discharged day hospital patients to provide some continuing support. Microfilm \$2.75; Xerox \$9.45. 207 pages.

**PREDICTING OUTCOME FROM SITUATIONAL
STRESS ON THE BASIS OF INDIVIDUAL
PROBLEM-SOLVING PATTERNS:
A STUDY OF MATERNAL COPING PATTERNS
IN THE PSYCHOLOGICAL STRESS SITUATION
POSED BY PREMATURE BIRTH;
RELATING THESE COPING PATTERNS TO
THE EARLY MOTHER-CHILD RELATIONSHIP.**

(Order No. Mic 61-2145)

David Meyer Kaplan, Ph.D.

University of Minnesota, 1961

The public health field has had conspicuous success in promoting and protecting the health of the community largely because of the effective control of acute infectious diseases. This study was made to test the possibility of formulating certain psychological problems in terms of the conceptual framework originally devised to understand and control acute infectious diseases. In this conceptual framework, emphasis is placed upon acute disorders of the normal, healthy individual in the community. Central to this approach is the study of current situational factors because of their significance in determining subsequent outcome.

A major goal in this study of the maternal reactions to the birth of a premature infant was to determine those factors of ego adaptation to a traumatic event which would be predictive of healthy or unhealthy early maternal care of the premature infant. The major hypothesis was that the successful resolution of the psychological tasks posed by premature birth would lead to a healthy outcome, i.e., satisfactory early maternal care of the infant. Conversely, it was predicted that the unsuccessful resolution of these tasks would lead to an unhealthy outcome, i.e., unsatisfactory maternal care of the infant.

The psychological tasks posed by premature birth require the mother to deal realistically with this total experience largely before the infant comes home. Soon after birth the mother has to recognize the threat to her infant, and accept her failure to deliver at term. As the infant progresses, the mother should respond by preparing for her future care of the premature infant whose needs differ from those of a normal infant. The mother should also come to believe that the premature infant will eventually become a normal child. The mothers who accomplish these tasks have successfully resolved the psychological problems posed by premature birth. Those mothers who do not accomplish these tasks have failed to resolve these problems.

The test of this major hypothesis and other related hypotheses was accomplished by independent ratings of

thirty longitudinal case studies of families in which a premature birth occurred. Each study consisted of a series of detailed interviews conducted in the home. They were begun shortly after the mother's discharge from the hospital, prior to the infant's homecoming. They were continued after the infant's discharge to home care, for a period of one to two months.

The ratings of the interview material were made by means of a schedule which was devised specifically for this study. Before ratings of the thirty cases were made the interview schedule, which is the basic measuring instrument of the study, was tested for inter-rater reliability.

An analysis of the ratings of the thirty cases confirmed, at a statistically significant level, the major hypothesis. Healthy and unhealthy maternal care of the premature infant was predicted by the success or failure of the maternal effort to resolve the psychological problems posed by premature birth. The prediction of outcome in the sample cases proved correct in twenty-four instances out of thirty, or eighty per cent accurate.

The results of this study of an acute psychological problem tend to support a growing conviction in social work that professional resources can be deployed to serve more people if greater efforts are directed to acute problems. The fact that professional resources are extremely limited, in relation to the large numbers in any community who need help with problems, makes this shift in emphasis more urgent. Microfilm \$2.75; Xerox \$8.20. 177 pages.

DEVELOPMENT OF THE MEDICAL CARE PROGRAM OF THE EGYPTIAN REGION OF THE UNITED ARAB REPUBLIC

(Order No. Mic 61-1029)

Ahmed Kamel Mazen, Ph.D.
Stanford University, 1961

The United Arab Republic is a progressing country which is presently doing its best to develop its economy and provide healthy living for its rapidly growing population. The purpose of this dissertation is to develop the medical care program of its Egyptian Region, taking into consideration the economic and social characteristics of the Egyptian society.

The economic and social characteristics and the existing medical care program are described in Part I. The great majority of the population depends on the free government medical services, and therefore most of the

emphasis is put on them. The Ministry of Health carries most of the responsibility of providing these free services. Part II discusses the essentials of a good medical care program. Part III evaluates the existing medical services and makes recommendations to develop them and correct their deficiencies.

In 1959 the centralized administrative system of the ministry of Health was changed into a decentralized regionalized one in preparation for the application of the System of Local Administration which was recently enacted. Both systems affected the administration of medical care in the Egyptian Region, and therefore they are evaluated and some recommendations are made to make the administrative system more conducive to good standards of care.

The existing methods of financing medical care are studied, and the possibilities for applying a prepayment or a nationalized system are examined. It is concluded that the Egyptian Region is not ready at this stage for nationalization of medical care though this is recognized as a goal for the future. A prepayment plan for all employed groups is recommended.

Planning the medical care programs is considered, and a mechanism and machinery are developed to make it active and continuous at both central and local levels.

Hospital facilities and services are evaluated and plans are drawn for their improvement. The regionalization and integration of medical services, the number of beds needed, the scope of services required, and the concept of the general hospital are discussed.

The internal organization of the Egyptian hospitals is evaluated. Selection of a hospital board from the community served, the employment of trained full-time administrators, the appointment of full-time chiefs for the clinical services, and the establishment of a private service in the government hospitals are recommended.

Since the hospitals of the Universities form a very important component of the medical care program of the Egyptian Region a complete chapter is devoted to examining their administrative structure. Some recommendations are made to develop this structure and to tie together the service, teaching, and research functions of these hospitals.

The public and private ambulatory services are examined, and their deficiencies are indicated. Many steps are described to improve them with special emphasis on the modern trend of expanding ambulatory services to relieve hospital inpatient services.

The educational and training programs for the medical and paramedical personnel are evaluated, and several recommendations are made to improve them and to guarantee adequate supply of qualified personnel at all levels.

Microfilm \$4.40; Xerox \$15.55. 343 pages.

HISTORY

HISTORY, MODERN

THE VERMONT PRESS
AND THE FRENCH REVOLUTION, 1789-1799.
(Order No. Mic 61-2639)

Judah Adelson, Ph.D.
New York University, 1961

Adviser: Leo Gershoy

The interaction between the American and French Revolution has never been adequately treated from the standpoint of the reflection of the French experience in American eyes. Vermont presents a most interesting and singular opportunity for such a local study because within its borders were to be found several varied regions and socio-economic groups.

Unfortunately such a study must necessarily be limited largely to the newspaper accounts. There is no mass of diaries, letters, or legislative minutes which contain the actual words of the representatives against which to evaluate the newspaper accounts. As a result the problem largely resolves itself into an intensive analysis of the coverage and omissions of the only extant major organ of public expression, the weekly press. Yet even here, it is to be noted, that in certain instances the entire corpus of newspapers is not extant.

A detailed study of the press has revealed that despite the regional differences evident in Vermont there was a uniform sympathy for the French Revolution at its inception. The traditions and heritage of Vermonters created this uniformity of opposition to absolute monarchy. Nevertheless as the revolution progressed and became more destructive of the old social order in France cleavages of opinion became evident. The various opinions expressed or implied in the Vermont press reflect the variety of regional differences within the state. Reports published in the more settled and conservative East tended to be less enthusiastic and more critical of the radicalism displayed by the Jacobins. The West, which encompassed the frontier communities, warmly endorsed the trend.

Most Vermonters displayed no hostility toward the King, but they expressed a keen distaste for the institution of monarchy. After the flight to Varennes, however, the underlying regional differences made their appearance. The execution of the King received the warm approbation of the westerners while the easterners showed much less satisfaction.

As the effects of the revolution spread beyond the borders of France and war became imminent, the eastern weeklies envisaged a dark future and predicted defeat. The radical West, fairly brimming with confidence, felt that the revolutionary spirit would result in French victories regardless of the odds.

One event of great impact on Vermont was the defection

of General Dumouriez. The journals saw it as the re-enactment of Benedict Arnold's treason and expressed horror and mortification. They now saw distinct parallels between the French and American revolutionary experiences, and their coverage increased.

Poor coverage of the Terror makes it difficult to evaluate accurately Vermont reaction, but the conservative East showed some disapproval while the frontier West regarded it as necessary. Only when Robespierre fell did all weeklies report the Terror as tyrannical.

The Democratic-Republican Societies, one of the first American pressure groups, were active in formulating radical Vermont opinion and relating it to American problems. Since all these clubs were to be found in the radical region, they led in formulating and buttressing opinion there.

When American interests became involved, the differences between the various segments of public opinion tended to be submerged. The signing of the Jay Treaty found Vermonters still divided, but the eastern view, that the treaty should be accepted, prevailed. When the more exciting XYZ Affair occurred Vermont achieved unanimity of public opinion, even if reluctantly on the part of the West.

The trend of Vermont political thought was in consonance with that of the country at large. Democracy was gaining adherents. Jefferson stood as the symbol of the future, and Vermont, with its radical tradition, as reflected in its attitudes toward the French Revolution, joined the larger movement.

Microfilm \$4.45; Xerox \$15.75. 348 pages.

THE EARLY AMERICAN LAW OF INTELLECTUAL PROPERTY: THE HISTORICAL FOUNDATIONS OF THE UNITED STATES PATENT AND COPYRIGHT SYSTEMS.

(Order No. Mic 61-2738)

Bruce Willis Bugbee, Ph.D.
University of Michigan, 1961

By a unanimous vote, and without debate, the Constitutional Convention of 1787 in Philadelphia adopted a provision empowering the future Federal Congress "to promote the progress of Science and useful arts by securing for limited times to authors & inventors, the exclusive right to their respective writings and discoveries." It is the purpose of this study to trace the early American precedents for the governmental protection of intellectual-property which led the Constitution's framers to agree so completely upon the creation of this new Federal power, which had no antecedent in the Articles of Confederation.

The study commences with a definition of intellectual

property, which is subdivided into literary property and "inventive" property--under both statutory and common law. The present-day law of intellectual property in the United States is examined for purposes of clarification, and legal, philosophical, and historical objections to the characterization of patents as "monopolies" are presented.

For historical perspective a survey of early patent and copyright protection in Europe is next included, emphasizing Renaissance Italy rather than England as the known birthplace of legal protection of intellectual property. The flourishing Venetian patent and copyright systems are described. It appears that emigrating Italians carried the patent concept abroad--notably to England, where it was grafted onto the existing royal practice of awarding monopolies. The Statute of Monopolies (1624), which prohibited the latter, specifically exempted patents of invention. England, however, permanently contributed the patent specification and also the copyright registry, which was later combined with the copyright Statute of Anne (1709).

The study then traces the evolution of patents in England's American colonies, of which the most active in the seventeenth century was Massachusetts. In 1641 this province enacted an anti-monopoly provision exempting patents (which Connecticut copied in 1672) and issued the first known American patents during the 1640s. In 1672 Massachusetts enacted the only colonial copyright law known. Considered individually are the patents issued by this and other colonies, which consisted of varying private acts passed in favor of particular inventors. These were at first crude in form but developed considerably by the mid-eighteenth century, when South Carolina briefly established a special patent procedure. The supposed general patent act of 1691 in South Carolina is shown to be merely a private grant. No general patent statute appears to have been enacted in America during the colonial period.

A greater outpouring of provincial patents during the Confederation Period, impelled by a continuing governmental desire to encourage new industries, was built upon colonial patent foundations. Among refinements added were the specification, the cancellation provision for non-invention, and increasing use of the English fourteen-year term. A parallel development was the passage of state copyright statutes influenced by the Statute of Anne.

South Carolina's copyright law (1784) included a general provision for patents, the first in America. Noah Webster's role in promoting these enactments may have been exaggerated, yet his interstate travels in search of broader copyright protection and the similar patent efforts of John Fitch and James Rumsey must have impressed state legislators with the inadequacy of parochial patents and copyrights. Thus the delegates to the Constitutional Convention of 1787 had the benefit not only of Europe's example but also of nearly 150 years of American patent tradition and several concentrated years of copyright experience. Microfilm \$5.45; Xerox \$19.15. 425 pages.

**THE FREE DEMOCRATIC PARTY
IN GERMAN POLITICS 1945-1956:
A HISTORICAL STUDY OF
A CONTEMPORARY LIBERAL PARTY.**

(Order No. Mic 61-1016)

Richard Sidney Cromwell, Ph.D.
Stanford University, 1961

The problem is to examine the character and evolution of a political party which claims to be the postwar representative of the German liberal tradition. Founded by former members of the Weimar liberal parties (the German Democratic Party and the German Peoples's Party), the Free Democrats averaged 10 to 12 per cent of the popular vote in elections between 1945 and 1956, generally held the balance in parliamentary bodies between the two large political parties, the Christian Democrats and the Social Democrats, and helped to shape the character of the Federal Republic. In some respects the party's behavior and influence during this period corresponded well with traditional western liberal conceptions in the political, economic, and cultural spheres. Thus it successfully fought Christian Democratic efforts to anchor confessional public schools in the constitution of 1949, helped to assure the adoption of Ludwig Erhard's neo-liberal economic program in 1947, and supported the establishment of a democratic parliamentary regime. In other respects, however, the actions of the Free Democrats frequently shocked liberal opinion in Western Europe and the United States. The party worked hard for the removal of restrictions on the public activities of former Nazis, and it solicited the electoral support of this element. In 1952 its branch in North Rhine-Westphalia adopted a program (the so-called German Program), calling for the establishment of a more authoritarian government in Western Germany. On foreign policy the Free Democrats consistently took a more nationalistic position than the Christian Democrats. Between 1956 and 1960 they demanded a neutralist West German foreign policy and opposed the Adenauer government. The neutralist line proved to be unpopular with the West German electorate; the party suffered heavy election losses; and its influence in West German affairs is now almost negligible.

Was the showing of the Free Democrats in the 1940's and early 1950's a purely evanescent phenomenon? Will they again have influence in German affairs? What is the real nature of the party? Is it truly liberal, or a nationalist and conservative party? To find the answers to such questions the author utilized interviews with Free Democratic leaders, as well as standard methods of historical research, such as study of newspaper files, party documents, election results, and works on the politics and sociology of the parties. The effort was to discover the basic pattern of the party's political behavior, to trace the correlation between this pattern and its historical background and social, economic, and confessional structure, and to assess the changing reactions of German voters to Free Democratic policy.

The results of the investigation revealed that in a very real sense the Free Democratic party contains two quite incompatible segments. In a few regions, where the Protestant professional, economic, and official middle class (which everywhere formed the bulk of the Free Democratic following) had genuine democratic traditions, the Free Democrats were also truly democratic in outlook. In other

areas--for instance, North Rhine-Westphalia--the party inherited a conservative, nationalistic background, and became essentially a substitute for defunct parties of the Weimar right. Its neutralist tendencies were partly a result of Protestant impatience over the reunification issue and partly a natural outgrowth of its nationalist background. The popular reaction against the Free Democrats' neutralist line was largely a result of the postwar German voter's suspicion of all parties favoring a bold course on foreign questions. Although the social and political bases exist for a moderately strong liberal party in West Germany, voter suspicion of the Free Democrats is now so great that any significant revival of this party in the near future is unlikely.

Microfilm \$4.95; Xerox \$17.55. 386 pages.

**THE RACIAL IDEAS OF THE AUTHORS
OF THE FOURTEENTH AMENDMENT**

(Order No. Mic 60-5906)

Lee Allen Dew, Ph.D.
Louisiana State University, 1960

Supervisor: Professor T. Harry Williams

Much of the confusion surrounding the question of race relations in the United States today has been due to the vacillation of the Supreme Court on the real meaning of the Fourteenth Amendment as applied to Negro rights and to the vagueness of the amendment itself. Today the Court has interpreted the amendment in an entirely different sense than was common fifty years ago. The purpose of this study is not to determine the correct interpretation of the amendment, but to attempt to discover what the ideas of the authors of that measure were in regard to the position of the Negro race in the United States. What did they believe this Constitutional provision would accomplish, and into what fields of race relations did they believe it would enter?

Many separate factors affect the ideas of men, and the Radicals were subject to many influences which helped shape their ideas and attitudes. Among these influences were the racial ideas of the North, particularly of the New England states, where most of them were born; the evangelical fervor of the Abolitionist movement, to which many of them subscribed; and the Free Soil movement, which many Radicals supported. As they gained political power during the years of the Civil War, they came under the influence of their constituents, who were responsible for their reelection, as well as military necessity in the winning of the war.

With the end of the war, the Radicals triumphed. Their ideas were enacted into law, and were later made more secure through incorporation into the Constitution. The climax of the Radical movement came with the three amendments which they authored, guaranteeing freedom, civil and legal equality, and suffrage. They did not attempt to legislate directly on the question of social equality, however, and made no direct reference to it, except to assure their constituents that such was not the intent of the Fourteenth Amendment.

Radicalism is enigmatic, and its history is open to

many interpretations. Two factors, however, become clear in the study of the racial ideas of the Radicals. They were influenced to a great degree by economic forces so that the demand for suffrage for the Negro was coupled with an insistence upon the abandonment of the drive for economic opportunities for the freedmen. Perhaps even more they were controlled by the movement which they had initiated. For by 1866 the drive for Negro rights had gotten out of hand, and was moving faster and toward greater goals than many Republicans either sought or approved. The demand for Negro rights had become popular, but at the same time that it was being endorsed by the voters of the North, some of its congressional supporters were becoming disillusioned. This is one of the tragedies of Reconstruction, that many of the men who voted approval of the Fourteenth Amendment interpreted its provisions as narrowly as possible, and saw it as a political expedient rather than as a guarantee of equal rights and equal justice for all.

Microfilm \$4.85; Xerox \$17.10. 379 pages.

**WILLIAM HENRY STILES:
GEORGIA GENTLEMAN-POLITICIAN.**

(Order No. Mic 61-1452)

Christopher Lee Harwell, Ph.D.
Emory University, 1959

Director: Bell I. Wiley

William Henry Stiles, 1809-1865, was an antebellum Georgian whose ambitions and achievements earned for him the appellation of gentleman-politician. Although primarily a politician, he was versatile. His varied interests modified his efforts to become a planter-statesman, and set him apart from many of his contemporaries.

Stiles's public career began in Savannah after completion of his education at Yale and admission to the Georgia bar. An aristocratic ancestry, supported by the family connections of his wife, the former Elizabeth Ann Mackay, facilitated his early advancement in Chatham County. He served three terms as alderman, was for a short time solicitor-general of the Eastern Judicial Circuit and later United States District Attorney for Georgia, and was elected in 1840 to represent Chatham County in the Georgia Legislature.

In the late 1830's Stiles moved to Cass County, in the relatively undeveloped Cherokee country of North Georgia. This move resulted from a combination of factors: doom to the cultivation of rice on Chatham lands, healthier climate, cheaper land, greater political opportunity, and a desire for independence, which could be more easily attained at "Etowah Cliffs," his new home, than under the protective care of the Stileses and Mackays in Savannah.

Stiles was elected on the general ticket to the Twenty-eighth Congress, and served as a loyal Democratic representative. In 1845 President Polk appointed him chargé d'affaires to Austria. There he served as the ranking United States official until 1849, creditably defending his nation's position on the Oregon problem, but less effective in interpreting the Mexican War. Stiles anticipated the Revolution of 1848, and his official conduct during the crisis not only earned a commendation from his superiors,

but was such as to avoid criticism from Austria and the short-lived rebel governments.

Stiles returned to the United States and reentered domestic politics at the time of the Compromise of 1850. As a supporter of the Southern Rights Party in 1850 and as a nominee for Congress in 1851, he suffered political reverses. His Southern rights views, tinged with unionist sentiment, had created the impression of confusion and made him unacceptable to either faction.

From 1852 to 1860 Stiles evolved into a strong sectionalist within the framework of the Democratic Party. He pleaded for party unity until its sectional division in 1860, and then advocated Southern unity. Stiles was mentioned as a possible nominee for governor in each campaign from 1853 through 1861, and he sought unsuccessfully the nomination for Congress in 1859. His chief political successes were election in 1855 to the Georgia House of Representatives and subsequent choice as Speaker, and election to the Georgia Senate in 1858.

Stiles's non-political interests were more pronounced during the 1850's. His educational interests were broad; his views on public education, strikingly modern; and his agricultural ideas and practices, advanced for his day. He consistently urged state support of railroads and other internal improvements, but his interest in manufacturing fluctuated. Several of Stiles's carefully-prepared speeches were printed, but his outstanding literary achievement was a two-volume work entitled Austria in 1848-49.

Stiles was loyal to Georgia and the Confederacy, but his experience as colonel of the Sixtieth Georgia Regiment and as a Confederate officer detailed to raise local defense troops in North Georgia demonstrated his unsuitability for military command. Contention, frustration, and disappointment followed, and these along with difficulties encountered in developing his newly-acquired lands in Terrell County, contributed to his death in 1865.

None of Stiles's accomplishments could be classified as brilliant, and he was admittedly not a leader of the first magnitude, but his career was varied and interesting, and the sum of his achievements was such as to entitle him to solid respect.

Microfilm \$4.65; Xerox \$16.45. 361 pages.

THE IWAKURA EMBASSY AND THE UNEQUAL TREATIES, 1871-1873.

(Order No. Mic 61-2661)

Marlene June Mayo, Ph.D.
Columbia University, 1961

Part of the diplomatic legacy of the new government established in Japan in 1868 in the name of the Emperor Meiji was a series of treaties of amity and commerce which had been concluded with several Western nations in the previous fifteen years. By their provision, Japan could neither alter tariff schedules at will nor try foreigners in its courts. None of the treaties could be terminated but all were subject to revision in 1872.

This is a study of how the Japanese came to consider these treaties unequal, of the motives which led to the dispatch of an embassy of almost fifty members in December, 1871, and of what that embassy did to help solve

the problem of diplomatic inequality. Its chief officials, headed by the ex-court noble, Iwakura Tomomi, were the first ambassadors of the Meiji government to the West. More significant, they were men who were in a position to direct the affairs of state: Iwakura himself, Kido Kōin, Ōkubo Toshimichi, and Itō Hirobumi. This is also a study of how such men as these learned the art of Western diplomacy--the practice of peaceful negotiations as a means of settling disputes between nations.

Experience early taught the Japanese the inconveniences of the treaties. Then by 1871, when they had become acquainted with international law and the arguments for protective tariffs, they began to criticize the treaties as unequal. They began to speak of lost tariff and judicial rights--rights which belonged to all truly sovereign nations. Although treaty revision was now Japan's foremost diplomatic concern, the Meiji oligarchs decided after considerable controversy that they were in no position to bargain in 1872 for more favorable terms. Legal and financial reforms would first be necessary. Instead, they requested indefinite postponement and commissioned the embassy to the West with a three-fold task: formal state visits; studies of the West for ideas which might prove useful in further reform efforts; and an exchange of views on the disadvantages of the treaties.

In Washington, however, after one interview at the State Department, the ambassadors made the startling decision to negotiate formally. Two of their number were shortly sent back to Tokyo to obtain proper credentials. The ambassadors even entertained hopes of later convening a joint revision conference in Europe of the remaining treaty powers. They had been encouraged by the enthusiasm of their American reception. Also, when they had themselves raised the possibility of an informal agreement on aims in future revision conferences, Secretary of State Fish had pointed to the practicality of concluding a treaty then and there.

Between March and mid-July, 1872, eleven interviews were held and three draft treaties were exchanged. Both sides made compromises. In spite of this and the issuance of full powers by the Tokyo officials--apparently with no conditions attached--negotiations were suspended by the ambassadors. They realized that their original reasoning had been correct. It was too soon for treaty revision. More to the point, a German diplomat had told them that the most-favored-nation clauses in the treaties could work to Japan's disadvantage in single-nation negotiations. With each new treaty, new concessions would have to be made. Joint negotiations were therefore a necessity, but Fish and President Grant were opposed to concluding an American treaty in Europe. Furthermore, the European diplomatic corps in Washington held out little encouragement. Subsequently, in Europe the Japanese ambassadors did more listening than talking, determined to avoid any further diplomatic entanglement on the trip.

Even though abandoned, the negotiations with Fish were not a complete fiasco. Nor were the talks in Europe useless. Fish had, in effect, been the ambassadors' lecturer in a course on international law and diplomacy. They learned much about the kinds of demands all Western governments would make of their country and the reasons which would be given to justify them. They had formulated the major arguments and contributed to the diplomatic devices which Japanese negotiators would use until the first

of the equal treaties was at last concluded with Great Britain in 1894.

Microfilm \$4.60; Xerox \$16.20. 358 pages.

**THE PASSAGE OF THE GOVERNMENT
OF INDIA BILL OF 1858**

(Order No. Mic 61-2149)

James Gregory Mc Aree, Ph.D.
University of Minnesota, 1961

In 1858 the British Parliament adopted the Government of India Act transferring responsibility for the administration of India from the English East India Company to the Crown. Historians have generally regarded the Act as a direct result of the Sepoy Mutiny of 1857 when the fate of British power in India hung in the balance for several months.

From the outset of the Mutiny opinion in Parliament and in the British press tended to hold the East India Company responsible for causing the disaffection of the army of Bengal. The whole system of Indian administration which had been in vogue since 1784, the so-called Dual Control System, was believed inappropriate to the task of governing such a vast dominion. Since the advent of the Dual Control System under the terms of the Younger Pitt's Regulating Act there appeared to be an evolutionary trend leading toward ever increasing Parliamentary control over the administration of India. It was not unnatural, then, that the Government of India Bill should be regarded as the final assumption of control and that it was precipitated by the Mutiny.

The central argument of this thesis is that while there was a connection between the Mutiny and the passage of the India Bill, there was an even more direct relationship between the Bill and political conditions which were English rather than Indian in origin. In 1857-58 the paramount political issue in England was the prospect for domestic political reform. Liberal Whigs, Radicals, and Peelites in Parliament were demanding a further installment of political reform while Tories and traditional Whigs opposed the proposition.

Lord Palmerston, the Prime Minister, singled out the issue of Indian reform as a device to divert attention away from the rising demand, even among his own followers, for Parliamentary reform. Indian reform could be justified both by the nature of the political crisis in India and the amount of popular excitement about the subject in Britain itself. The shrewdness of his judgement was proved shortly after the introduction of the first draft of the Bill when Palmerston fell from office and was succeeded by a Conservative Ministry under Derby and Disraeli. It might have been expected that the Tories would drop the India reform measure. They were obliged, as a matter of practical politics since they were in a minority, to proceed with their own version of the India Bill.

As the debates proceeded it became apparent that the central issue revolved around the disposal of the Indian patronage. Left in the hands of politicians the vast patronage of the Indian empire would be tempting to a party in power and an intolerable offence to the opposition.

A way was found around the vexing subject when all offices of the Civil Service and Army of India were opened by the statute to candidates who successfully passed a public examination. Microfilm \$4.05; Xerox \$14.20. 315 pages.

**THE FEDERAL FRESH-WATER NAVY
AND THE OPENING
OF THE MISSISSIPPI RIVER:
ITS ORGANIZATION, CONSTRUCTION, AND
OPERATIONS THROUGH
THE FALL OF VICKSBURG.**

(Order No. Mic 61-2775)

John Drane Milligan, Ph.D.
University of Michigan, 1961

This study traces the history of the Federal Navy in the Mississippi Valley from its inception, at a time when the great river was closed to Federal commerce, until vessels from the Northwest were again unloading their products at New Orleans. It is especially concerned with the role of the river service in helping to resecure the use of the waterway for the Union.

The opening chapter outlines the economic and military importance of the Mississippi River in the 1860's, both as it was interpreted by Americans, North and South, of that era and as it is understood by present-day students of that period. In the first years of the war citizens of the upper valley were convinced that Northern conquest of the river was the most important economic and military objective of the conflict. The second and third chapters describe how this conviction led to the construction of the fresh-water navy. The following nine chapters are mainly concerned with the operations of this navy, but also devote due space to its administration and expansion.

The woodclad gunboats in their shakedown engagement at Belmont on the Mississippi proved their worth by saving the cooperating army from a critical embarrassment. The ironclad gunboats in their shakedown engagement at Fort Henry on the Tennessee reduced their objective with alacrity. This action earned for them a reputation for invincibility which ignored the fact that their triumph had been due largely to serious disadvantages inherent in the site of Fort Henry. The position of Fort Donelson on the Cumberland suffered from no such limitations, and here the Confederates set the record straight by handing the navy a severe repulse. After Henry and Donelson were neutralized, however, the gunboats demonstrated their most important strategic asset—their ability to range through enemy territory wherever rivers were navigable—for unlike the railroads, watercourses could not be torn up by the enemy. This was a portent of events on the Mississippi itself.

Once Federal moves up the Tennessee and Cumberland had turned every Confederate position on the larger river above Memphis, and once the Federal flotilla had destroyed the last Confederate fleet in front of that city, the Mississippi was open down to the next defensible riverbank position, or Vicksburg. Three Northern efforts to reduce this bastion followed. In each the role of the Federal Navy increased in importance. Farragut had already secured the Mississippi up to Port Hudson. When Vicksburg finally

succumbed, and with it Port Hudson, the river was conquered, the Confederacy split in two, and the blockade of the Old South complete.

The conclusion to be drawn from this study concerns the contribution made by the Federal fresh-water navy. Because water furnished the only unbreakable highway through enemy territory, the part played by this service continued to grow. So much is this true, that in the final operations the navy was the indispensable partner of the army, and made possible the particular tactics employed to reduce Vicksburg and thereby open the Mississippi to the Gulf. Microfilm \$7.45; Xerox \$26.35. 585 pages.

**ANSCHLUSS:
GERMAN-AUSTRIAN RELATIONS, 1933-1938.**

(Order No. Mic 61-2780)

William James Orr, Ph.D.
University of Michigan, 1961

The purpose of this dissertation is to show how and why Anschluss came about by tracing the course of German-Austrian relations during the years 1933-1938, presenting both a study in Nazi diplomacy and European diplomatic history of the 1930's. The dissertation is based principally on published diplomatic correspondence, war crimes trials materials, and memoirs.

It is shown that Hitler always intended to annex Austria, both for reasons of Pan-German sentiment and as a part of a long-range goal of acquiring eastern Lebensraum. But, since he preferred to maintain a façade of legality and did not wish to provoke the powers into preventive measures until he had achieved rearmament, he sought the "automatic solution" in Austria by "peaceful evolution." This meant that the Reich-directed Austrian NSDAP should gain control of the Government by infiltration and subversion, bringing about initially Gleichschaltung, or "co-ordination," between Vienna and Berlin; Anschluss could come later when the international situation would permit it.

The tactics of legality were frustrated by the Fatherland Front regime of Dollfuss and Schuschnigg, which outlawed and tried to suppress the NSDAP. For reasons of common-German sentiment, and because the propaganda and economic pressures from the Reich were disrupting Austria, Dollfuss and Schuschnigg desired to restore normal and friendly relations with the Reich, provided Hitler would abandon the Austrian NSDAP and recognize Austria's sovereignty and independence. This Hitler refused to do.

By 1936, however, the international situation had made it expedient for the Austrians and Germans to come to terms. The result was the July Agreement, wherein Schuschnigg conceded the promise of political responsibility for the National Opposition and for some German Cultural penetration, in return for Hitler's recognizing Austrian independence and a promise of economic benefits. There followed two years of wearisome and futile negotiations in an attempt to implement an agreement into which neither state had entered in good faith, the Reich especially, since Hitler conceived of it as only another means of achieving peaceful evolution.

By the winter of 1937-1938 Hitler felt that Germany's

rearmament and the general international situation permitted a definitive solution of the Austrian problem. Under threat of military intervention, he forced Schuschnigg to agree to implement the July Agreement at the Berchtesgaden meeting of February 11, 1938. Expecting that peaceful evolution now had some prospect of success, Hitler was intensely irritated by Schuschnigg's attempted plebiscite, which threatened to expose five years of Nazi propaganda as a fraud and, perhaps, to rally world public opinion in Austria's favor. Combining legality and the solution by force, a German ultimatum forced Schuschnigg's resignation and the establishment of a Nazi front regime which, in turn, requested the entry of German troops "to restore order." This seizure of Austria was confirmed a month later, in April, by a German-organized plebiscite.

The conclusions that one may draw from this study are that Austria could maintain its independence only as long as it could expect aid from abroad, and this prerequisite was lost by the winter of 1937-1938; nothing Schuschnigg could have done would have staved this off; and Hitler had decided by this time that no one, not even Italy, would prevent him from taking over and annexing his former homeland. Austro-German Anschluss was inevitable due to the determination of Hitler and the attitude of the powers.

Microfilm \$4.90; Xerox \$17.35. 384 pages.

THE LITTLE STEEL STRIKE OF 1937

(Order No. Mic 61-2851)

Donald Gene Sofchalk, Ph.D.
The Ohio State University, 1961

The essential purpose of the dissertation is to provide a historical narrative and interpretation of the strike called by the Steel Workers Organizing Committee (SWOC) of the CIO against the four steel firms--Bethlehem, Republic, Youngstown Sheet & Tube, and Inland--known collectively as Little Steel. Particular attention is paid to the influence of public opinion, the outbreaks of industrial warfare, and the relation of government, both state and federal, to the strike. Extensive use is made of the La Follette Committee Hearings, NLRB Decisions, and numerous newspaper accounts.

A chapter is devoted to the history of Labor policies and practices in Little Steel. Bethlehem, Republic, and Sheet & Tube were found to have had a record of firm opposition to trade unionism. This explains in large measure their refusal to meet the union demand for formal recognition by way of written contracts. The details of the strike itself, including the strategy and techniques employed by SWOC and management, are set forth in several chapters. The circumstances and events of the "Memorial Day Incident," the most serious eruption of industrial strife during the strike, are discussed in one of these chapters.

The companies' effort to turn public sentiment to their advantage and the bearing which public opinion had on the outcome of the strike are considered. Opinion in the steel communities affected, as well as that of the general public, is analyzed. This analysis is based on opinions expressed in newspapers and periodicals and in Congress.

The Chapter on government intervention considers the role of the Roosevelt administration's National Mediation

Board, the introduction of state police in Pennsylvania and militia in Ohio to maintain a status quo during the Board's ill-fated attempt to effect a settlement, and the subsequent use of state forces to provide protection for back-to-work movements.

The conclusions are that adamant and united resistance by Little Steel, a public sentiment generally critical of the strikers and their methods, the use of troops as strike-

breakers, and the unexpected reluctance of the New Deal to support SWOC combined to bring defeat for the new union in its first major strike. At the same time, however, the companies' objective of inflicting a mortal blow on the CIO by breaking the strike fell far short of realization. Within a few years SWOC obtained written agreements from these very concerns that had most vigorously opposed it.

Microfilm \$5.30; Xerox \$18.70. 415 pages.

HOME ECONOMICS

FAMILY SIZE AS RELATED TO CHILD-REARING PRACTICES

(Order No. Mic 61-2352)

Josephine Alice Rusher Bartow, Ed.D.
The Pennsylvania State University, 1961

The size of the family has been thought to be an important factor influencing the behavior of parents and the adjustment of children. The purpose of the present study was to investigate the relation between certain child-rearing practices and family size.

A stratified sample was drawn, using the school census records in an industrial city of 140,000 population. There were 100 white, nuclear families, ranging in size from one to ten children, and each family had an eleven-year-old child. The mothers were interviewed, using a structured interview schedule. Data were tabulated according to family size, from one-child families to those with six or more children.

The mothers had an average of 10.76 years of schooling, and the fathers had 11.35 years, the mode being high school graduation. The majority of the fathers were employed in the clerical and skilled trades and the semi-skilled trades, with few professional people or few day laborers. None of the mothers were employed outside the home. There were no statistically significant differences among family sizes in the educational level of the parents or the occupation of the fathers.

Hypothesis 1. The problems expressed by mothers in dealing with their eleven-year-olds are not significantly related to family size. The product moment correlation of the number of problems reported among the different family sizes was .18, a statistically non-significant correlation indicating little or no relation between the two factors. Mothers of five or more children reported slightly more problems with their eleven-year-olds than mothers of smaller families. Problems reported ranged from none to nine per family, with an average of 4.44 for three-child families to 5.53 for five-child families.

The problem of the child talking back to parents showed significant differences among family sizes; it was reported with greatest frequency by mothers of one child and least by mothers of three children.

Hypothesis 2. The number of rules the mother expects the eleven-year-old to follow is not significantly related to family size. A small but statistically significant correla-

tion of .20 was found between the number of rules reported and family size. There were regular but slight increases in the average number of rules for families with one through four children, with fewer rules reported for families with five or more children. Within each family size, mothers reported the largest number of rules for play and the fewest number for the use of television.

Hypothesis 3. The methods of discipline used by mothers with their eleven-year-old children are not significantly related to family size. It was found that the methods of discipline used did not differ significantly among family sizes. The methods reported used frequently with eleven-year-olds in all family sizes were praise, reasoning, helping the child with a task that seemed too difficult for him to do alone, and scolding.

Hypothesis 4. The degree of independent behavior encouraged for the eleven-year-olds by mothers is not significantly related to family size. Encouragement of independence was measured in two ways, by the number of decisions the eleven-year-old child was reported as making for himself as compared to those his parents made for him, and by the amount of freedom parents allowed in activities. Parents made more of the decisions concerning the child, on the average, than did the child; the correlation coefficient was -.07, which was not a statistically significant figure. Parents were quite restrictive of the activities for their eleven-year-olds on such items as going to the movies without an adult, or staying alone in the daytime or at night, but there were no statistically significant differences according to family size.

Summary and Conclusions. The major hypothesis of this study was that certain child-rearing practices used by mothers in dealing with their eleven-year-old children are not significantly related to family size. There was insufficient evidence throughout the study to reject the null hypothesis, with the exception of the number of rules and the problem of the child talking back to parents which showed significant differences when related to family size. It may be that family size is not as important a factor in family living as has been believed, at least in relation to the behavior of mothers, although some trends were apparent which seemed to indicate that further study might demonstrate some significant differences.

Microfilm \$2.75; Xerox \$6.40. 135 pages.

**A STUDY OF THE CONSUMER ROLE
OF A SAMPLE OF YOUNG ADOLESCENT GIRLS
IN GRADES SEVEN, EIGHT, AND NINE IN
IRVINGTON, NEW JERSEY.**

(Order No. Mic 61-2563)

Irene Gartner Oppenheim, Ph.D.
New York University, 1961

Chairman: Professor Henrietta Fleck

The purpose of this study was to discover the consumer role of girls, age twelve to fifteen, in the seventh, eighth, and ninth grades of the Irvington, New Jersey public schools during a selected two week period.

The design of this study was planned to furnish information about this group. The data for this study were gathered during the first two weeks of April, 1959. A random sample was drawn from the population of all girls in the grades seven, eight, and nine in the public schools of Irvington. This sample was rated for social class according to Warner's scale.¹ From this sample group, four social class groups, the lower-middle; the indeterminate, lower-middle or upper-lower; the upper-lower; and the indeterminate, upper-lower or lower-lower, were selected. These four groups comprising a total of seventy-two girls were a proportionate sample of 89.5 per cent of the students. The expenditures of this group were also analyzed according to age level.

The significant differences in the expenditures made or influenced by the girls in the four social class groups and three age groups were tested by the analysis of variance. The five per cent level was accepted as the level of confidence. The one area in which there was a significant difference was: The mean expenditures of the families making purchases during the first week of the study of expenditures, for the girls in the four social class groups which were influenced by the girls.

The significant differences in the number of purchases made or influenced by the girls in the four social class groups and the three age groups was tested by the Chi Square analysis. The five per cent level was accepted as the level of confidence. There were significant differences in:

- a) The number of purchases made by the girls in the four social class groups;
- b) The number of purchases for their families made by the girls in the four social class groups during the two week study of expenditures;
- c) The number of purchases made by the family for the girls in the four social classes which were influenced by the girls;
- d) The number of purchases made by the girls in the three age groups.

The data seem to indicate that there is not a significant difference in the expenditures of urban girls age twelve, thirteen, and fourteen in grades seven, eight, and nine according to social class status. Some differences seem to exist in the frequency of purchases. This suggests that the spending patterns of this age group may be related to the peer group standards. It also appears that the expenditures of urban junior high-school girls increase with each

age level. This seems to suggest that each age level has its own standard of expenditure. The influence of junior high-school girls on family expenditures seems to be confined to expenditures for food and soft goods.

The investigator believes that this study of the consumer role of one group of junior high-school level girls might be useful to supplement existing data on family economic behavior, and to provide additional data useful for planning consumer education at the junior high-school level.

1. Some slight modifications of Warner's Scale were made. These are described in Appendix B.

Microfilm \$6.05; Xerox \$21.40. 475 pages.

**CONSTRUCTION OF A PROBLEM CHECK LIST
FOR HOSPITAL DIETETIC INTERNS**

(Order No. Mic 61-2858)

Margaret Ann Wilson, Ph.D.
The Ohio State University, 1961

One of the newer approaches to helping both a student and a teacher to better understand the former is the use of problem check lists, through which the student communicates his views of himself, his environment, and his concerns. The hypothesis of this study was that dietetic interns in hospital programs have enough concerns related to their educational situation to warrant the development of a problem check list specific to hospital dietetic internships.

To obtain information regarding such problems, students in the fifty-six hospital dietetic internships in operation in August, 1958, were invited to participate in the study. A total of 399 interns in 75 per cent of the programs participated. In order to secure original statements of concerns from a large number of students at various stages of their internship experience, each intern was asked to contribute three times during a seven-month period. During the first of the three surveys each intern was asked to list her current concerns and then to describe in detail one problem incident which she had experienced. Approximately twelve weeks later the interns repeated this performance and also marked a rough draft instrument developed primarily from their first contributions. The third survey, about twelve weeks later, provided an opportunity for the interns to mark a further revised instrument indicating the concerns they had experienced at any time during their internship.

Two groups of professional people also contributed to the development of the check list. One group, consisting of some of the leaders in the field of hospital dietetics, reviewed the contents of the rough draft instrument. A second group, composed of educators and dietitians, classified the statements on both the rough draft and provisional instruments into major categories of problems, such as instruction, environment, and patient relationship.

Criteria were established to aid in the selection and refinement of phrases for the check list.

While this study deals primarily with the problem aspects of the internship experience, it by no means implies that only the negative exists. The instrument provides

space for the intern to identify her satisfactions, for this encourages her to think in terms of the total experience, and also provides the teacher cues for a positive approach in counseling with the intern.

A number of evidences can be identified to support the construction of this instrument. (1) Over 800 concerns were identified in Survey I, and additional problems were recognized in the second survey. (2) The frequency with which each check list item was marked during the second and third surveys supplied evidence. (3) Of the 333 statements on the final instrument, 270 are so specific to hospital dietetics that they would not be found on any of the other available check lists, and many of the remaining 63

phrases (which deal with the intern's general characteristics) express concerns not adequately represented on other check lists. In addition, the frankness with which the interns expressed their critical incidents, the complexity of many of their problem situations, and the intensity of many of their concerns evidenced their need for help. A careful study of the interns' contributions could only lead the writer to conclude that interns need help in communicating and in solving their problems, and that the construction of a problem check list for hospital dietetic interns was warranted.

Microfilm \$2.75; Xerox \$8.00. 174 pages.

JOURNALISM

STUDY AND CRITIQUE OF THE STATUS OF JOURNALISM IN THE AMERICAN TWO-YEAR COLLEGE (Order No. Mic 61-2077)

Dewey Wayne Rowland, Ph.D.
Southern Illinois University, 1960

Supervisor: Professor Clarence D. Samford

This study is concerned with the status, trends and proper place of journalism in the American junior college. Recognizing the increasingly prominent role of the two-year college in the American education system, and the importance of a well-qualified and responsible journalism to a free and democratic society, the study undertakes to determine and report the present status of junior college journalism and the implications for the profession and for society.

Data for the study were taken from a review of pertinent previous studies and reports and from five questionnaire surveys of institutions, individuals and organizations concerned and affected by the problem: junior colleges, junior college journalism teachers, journalism educators and professional schools and departments of journalism, and junior college graduates in journalism careers.

The history, role and status of both the junior college and journalism education are reviewed. Current problems and practices in journalism, journalism education, and junior college education are reported from data compiled and interpreted. The findings indicate that one out of four junior colleges offers one or more courses in journalism, but not more than twenty offer a terminal occupational journalism curriculum. In most instances only one person teaches journalism, usually in addition to teaching other subjects or to other college responsibilities. Journalism enrollments are small, most students do not plan journalism careers, and fewer than one out of seven journalism-bound students attempt to enter journalism careers without further education beyond the junior college. Junior colleges offering journalism tend to be larger enrollment institutions and those offering the most in journalism have

the largest enrollments among these. Publicly supported junior colleges generally have larger enrollments and offer more in journalism. The majority of junior colleges that offer journalism do so primarily to facilitate production of the college newspaper.

Persons teaching journalism in junior colleges are better prepared academically than they were ten years ago, but most are not qualified either by education or experience to teach journalism. Three out of five of those reporting have had neither a journalism major or minor on any degree and most have had little or no professional experience in journalism.

Except in news-editorial work and management positions, persons in seven job categories on a sample of thirty-eight newspapers have had less than two years of college. Newspapers generally rated junior college preparation adequate for most newspaper jobs except editing wire news, copy editing, and editorial writing. Senior college journalism educators, almost all junior college journalism teachers, and almost all junior college graduates working in journalism oppose terminal journalism training at the junior college level, when journalism is defined as the actual gathering of facts and writing, reporting and interpreting the news.

Although two-year terminal education beyond high school is not adequate preparation for journalists, it may be sufficient for certain jobs related to and supporting professional journalism, the investigator concludes. A general education journalism course--"Journalism and Mass Communications in Society"--is recommended as having a useful and proper place in the junior college for transfer, terminal and adult education students alike. A second journalism course--"The News and Beginning Reporting"--is approved for those students who plan to continue education for journalism careers, but only if there are adequate facilities and a qualified instructor. Better articulation between professional journalism education and junior colleges is urged, in the best interest of all concerned, and certain recommendations for meeting the problems identified in the study are set forth.

Microfilm \$7.20; Xerox \$25.65. 568 pages.

ORGANIZATION AND ADMINISTRATION
OF INFORMATION SERVICES IN
LAND-GRANT INSTITUTIONS

(Order No. 61-2984)

Kenneth Eugene Thomas, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Alton C. Johnson

Purpose

This study was concerned with exploring, describing, and analyzing relevant factors associated with the following aspects of information services in land-grant institutions: (1) organizational structure; (2) administrative relationships; (3) functions, responsibilities, and objectives; (4) personnel qualifications and characteristics; and (5) problem areas. Particular emphasis was given to the information services in four land-grant institutions in which the total information programs had been administratively centralized.

Methodology

Data were obtained from heads of information services in 47 of the 50 states through the use of mail questionnaires. At four institutions with centralized information services, 71 personal interviews were conducted with individuals in the following categories: (1) presidents; (2) directors of information; (3) deans of agriculture; (4) directors of Extension; (5) non-agricultural administrators; (6) information service personnel; and (7) Extension specialists and supervisors. For the purpose of analysis, respondents were categorized according to the size of their information staffs and according to the organizational type of their information services. Correlations were computed by applying Spearman's rank-order correlation coefficient and Kendall's coefficient of concordance.

Findings and Conclusions

In recent years there has been a trend toward increased centralization of information services. Also, approximately 40 per cent of the respondents in noncentralized information services believed that information services within their institutions should become more centralized. At the time of this study, information services in land-

grant institutions were organized as follows: (1) in seven institutions, the total information programs were administratively centralized; (2) in 32 institutions, all agricultural information activities were centralized but separated from general university information; and (3) in eleven institutions, there were numerous independent information units, including two or more within the agricultural area.

The major reasons for administratively centralizing information services were: (1) to more effectively and efficiently utilize personnel and other resources; (2) to comply with the basic principles of administrative organization; and (3) to put into effect an expanded information program. Among interviewees, there was a high level of satisfaction relevant to a centralized type of information service.

There was considerable variance between the extent to which heads of information services believed they should participate in policy and program formulation and their actual involvement. In general, heads of centralized information services and heads of services with the larger staffs were more fully involved in administrative developments and policy and program formulation than were the other heads of information services.

There was a high correlation of perceptions between the different categories of heads of information services regarding the relative importance of functions, responsibilities, and objectives of information services. The five most important functions, responsibilities, and objectives were: (1) to maintain good relations with mass media personnel; (2) to provide educational materials to be used by mass media; (3) to provide training in mass communications for county Extension personnel; (4) to provide training in mass communications for state Extension personnel; and (5) to provide materials to county personnel to support county programs. The lack of adequate personnel and resources to provide essential services was the most serious problem confronting information services.

Predominant factors responsible for the degree of success attained by the centralized information services were: (1) staff competency; (2) organizational structure; (3) quality of administrative leadership; (4) top-level administrative support; and (5) available facilities and resources.

All indications point to the human element as being the pre-eminent factor in an organization (supporting elements are such factors as administrative organization, administrative leadership and support, resources, and facilities).

Microfilm \$3.10; Xerox \$10.80. 240 pages.

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

A HISTORICAL AND CRITICAL STUDY OF BROWNING'S ASOLANDO VOLUME

(Order No. Mic 61-2871)

Paulina Estella Buhl, Ph.D.
The University of Tennessee, 1961

Major Professor: K. L. Knickerbocker

Asolando Fancies and Facts, Robert Browning's last volume of poems, was completed during his final visit to the Italian village of Asolo, which he had loved since his youth, and was published in London on December 12, 1889, the date of his death. This coincidence meant that the reviews of Asolando were either obituaries or examinations of the entire body of the poet's work. The neglect is unjustifiable both because the volume includes some of Browning's best poetry written after The Ring and the Book (1869) and because it is an important aid in a study of the development of his poetic style.

To the superficial reader Asolando may appear to be merely a miscellaneous collection of poems having no unifying theme, but actually it is a carefully planned volume in which each poem is related in some way to the subtitle, Fancies and Facts. A consideration of the relative value of fancies and facts, of appearance and reality, is found in much of Browning's poetry, both in short poems and longer works, being particularly emphasized in his masterpiece, The Ring and the Book, but here this question receives its most thorough treatment.

The thirty poems are divided into three categories--love poems, narrative poems, and philosophical poems--indicating three prevailing realms of interest throughout Browning's poetic career. The narrative and philosophical works are not unusual productions for an elderly man, but the love poems have surprised many by their youthfulness and spontaneity. A close examination of the Asolando poems (under the headings: criticism, paraphrase, interpretation, source, correlation with other poems, imagery and diction, and form) shows that the book is clearly in the direct line of the poet's development.

In his last years Browning did not turn to new and untried sources for inspiration and factual information. Most of the sources were ones he had used consistently, and occasionally, as in his preference for Latin rather than Greek sources, he seemed in Asolando closer than to other works after The Ring and the Book. The factor which most definitely sets his use of source materials apart from his custom during his middle period is the frequency with which he has drawn upon his experiences for source material.

An examination of the subjects and themes employed in Asolando reveals many of the same results. Browning introduced no new subjects, and many of those most fre-

quently used had appeared consistently since Pauline and Paracelsus, his very first works. On the other hand, he was prone to go back to subjects such as love and the perfect moment, which he had rarely used in the philosophical poems written during his last years, and to give them renewed emphasis.

The imagery and forms used in the Asolando poems do not show any new development in style, but they do show that until the end of his life Browning retained the ability to use both with great effectiveness. The imagery was generally drawn from the same sources he had used earlier. Some of the Asolando poems have less imagery than is found in those in previous volumes, probably because the poet chose to write with more brevity. Here, as was generally true of his work, the imagery and form were chosen to fit the tone and subject of the poem, and they therefore make a significant contribution to the organic unity, an element of prime importance in Browning's work.

Although their brevity, compactness, and lightheartedness seem to make the poems contained in Asolando more closely akin to the poet's work prior to The Ring and the Book, the themes and philosophical attitudes are clearly related to Browning's thinking throughout his creative life.

Microfilm \$4.15; Xerox \$14.65. 324 pages.

ENCHANTED WILDERNESS: A COMMENTARY ON THOMAS MORTON'S NEW ENGLISH CANAAN.

(Order No. Mic 61-2658)

Donald Francis Connors, Ph.D.
Columbia University, 1961

In the first division of his work, Morton writes knowingly of the manners and customs of the Indians. His tales of local chieftains and powwows, several of which were borrowed later by Washington Irving and by John Greenleaf Whittier, reveal his skill as a narrator. Propaganda of a sort is seen in his stout insistence on the humanity of the natives and his plea for their religious instruction along lines formally approved of by the Church of England.

Morton's detailed and generally accurate account of the natural resources of New England, presented in Book II of the New English Canaan but anticipated in earlier passages of his work, is valuable for the information it contains. Familiar with the shoreline, the rivers, and the interior of the country, from Rhode Island to Maine, he calls attention to the benefits which the individual trader or planter, and the English nation as a whole, may reap by possessing and controlling the wealth of the region. In such remarks, and in his praise of those Englishmen who were active in the development of the country, a note of propaganda may be heard in Morton's report.

But Morton's interests in New England were not solely practical or opportunistic. He was also a man of sensibility. As he describes his land of milk and honey, an Arcadian scene emerges. Pastoral imagery and frequent allusions to Biblical and classical literature poetize the beauty of the wilderness scene. Underlying all are familiar Renaissance ideals of order, degree, and harmony. Fused together they form Morton's epithalamium for "Faire Canaan."

The third and final section of the New English Canaan is a brilliantly conceived and executed satire on the Separatists and Puritans. Their chief men are portrayed in comic and ludicrous roles. The incongruities of human behavior are also pictured in some of the less familiar figures of the times. In this book is found Morton's widely read account of the gay revelers around the Merry Mount Maypole, an episode which has awakened both literary and historical responses. In the second half of Book III, Morton recites the tenets of the New England churches and relates incidents designed to show the lack of justice and humanity in the leaders of the settlements. Playing the role of an aroused Jonas, he concludes his book with a dark prophecy that the wicked soon will be punished.

Microfilm \$2.75; Xerox \$9.00. 198 pages.

**THE LITERARY REACTION
TO THE EAST INDIA COMPANY,
1760-1804.**

(Order No. Mic 60-4745)

Phillips George Davies, Ph.D.
Northwestern University, 1960

The purpose of this study is to examine the literary reaction to the East India Company during the years 1760 to 1804, and to place the literature dealing with the Company servant against its political and historical background. During this period the British Parliament, newspaper writers, novelists, essayists, and poets all concerned themselves extensively with Company policy, the results of that policy in India, and the visible signs of its consequences in England -- the nabob or English employee of the Company who gained a fortune in India and returned to England an immensely rich man.

Time divisions have been somewhat arbitrarily made to mark the various stages of public interest. During the period from about 1760 to 1769 little was known about Indian affairs except the military victories of Lord Clive. Then, in 1769, India was suddenly brought into the lime-light by the great famine in Bengal, the financial troubles of the Company, and the return of a few rich Company employees.

The second chapter covers the crowded years from 1770 to 1773, beginning with the growing controversy over the nabob issue, and ending with the passage of North's Regulating Act in 1773. In this period the nabob came under full-scale attack for the first time.

The third chapter, 1774 to 1785, considers the years when national hatred of the Company was at its height. Numerous instances of parliamentary election irregularities on the part of the nabobs were disclosed, and parlia-

mentary investigations were made into the affairs of the Company.

The fourth chapter deals with the trial of Warren Hastings and the period from 1786 to 1804, and demonstrates that in spite of the notoriety of the trial, public interest in the India question was definitely flagging.

Among imaginative writers, the record shows that the poets were typically the first to respond to new developments in India and at home. Together with the essayists, they worked in closest association with the political and social commentators. They hailed the first news of Clive's brilliant victories; then, when the luster attached to Clive's name dimmed, they joined in the attack and produced satirical verses intended to arouse public indignation against the whole nabob group.

The drama of the day was not customarily employed as a vehicle for political and topical commentary. Apart from Foote's The Nabob, little that is fresh or immediate is added to the picture of the nabob in English society by the handful of plays that make use of such characters. It is evident, however, that Foote's drama helped to impress the stereotype upon the public imagination in a surprisingly permanent manner.

Of all the contemporary forms of imaginative writing, the novel made the most extensive use of the nabob. The villains are the more striking figures, and later commentators have sometimes given the impression that they were more numerous and more characteristic than the opposite species. Actually such was not the case. The kind and generous nabob appeared far more frequently in the novel, although both bear only a superficial resemblance to actual returned Englishmen of the day.

Indian material in prose fiction, drama, and poetry between 1760 and 1804 provides a striking example of the manner in which a public question occupied writers of various kinds over the course of forty years, and the degree to which their views were and were not modified by the real conditions of the times. In addition, we can see the way in which literary modes and traditions reshaped and modified contemporary events to incorporate them into imaginative writing, and how literature established, in consequence, a pattern of reality based on, but by no means parallel to, actual happenings.

Microfilm \$4.90; Xerox \$17.35. 381 pages.

**A CRITICAL ANALYSIS
OF JOHN DRYDEN'S
THE HIND AND THE PANTHER**

(Order No. Mic 60-3646)

Harry James Ellis, Ph.D.
(Brother Felician Patrick, F.S.C.)
University of Pennsylvania, 1960

Supervisor: Dr. Maurice Johnson

Critics and scholars have always recognized John Dryden's apologetic purpose in the fashioning of the allegory, The Hind and the Panther. However, they have given scant attention to the more properly literary values of the work. Setting aside the theory that poetry can be made from

abstract reasoning only by the most inspired, or only with mediocre success, or not at all, the present study gives this neglected major work the benefit of a long, close look, very possibly the first such scrutiny it has ever received as an end in itself. Viewed mainly in terms of artistic values, the work must be allowed to emerge as a poem, not merely as a contribution to seventeenth century apologetics, nor as a footnote to the political history of England, nor as a climax in the life of its author.

The chief method used in the detailed analysis has been to consider each of the poem's 2592 lines in terms of ten major categories, most of which later became the bases for chapters of the dissertation. These categories were the following:

1. Content: doctrine, narrative, autobiography, etc.
2. Role of the line in the total argument.
3. Rhetorical patterns and figures of speech.
4. Sound patterns: alliteration, consonance, etc.
5. Allusions: literary, Biblical, folkloric, etc.
6. Tone: irony, invective; but also reverence, emotional attachment.
7. Satiric devices: diminution, materialization, the disclaimer, etc.
8. Miscellaneous structural elements, e.g. glosses.
9. Links and connectives.
10. Voice and address.

As the hundreds of separate entries grouped themselves around these tentatively-placed poles of attraction, the chapters developed in this order:

- I - Rhetoric
- II - Figures and Narrative Frame
- III - Tone
- IV - Voice and Address
- V - Patterns of Sound

Appendix "C" - Meaning: the "Prose Statement" of the Poem.

The chief result of this long procedure has been the revelation of a major art work of great but uneven merit, one that tends to sum up all the elements of Dryden's career. The dramatist skillfully manages the allegorical frame and dialogue; the satirist controls the tone well and at times dazzlingly; the translator draws upon his classical background; and the rhetorician fashions clear verse from abstract ideas. If an occasional metaphor clouds a doctrine instead of sharpening it, if an occasional couplet is padded, and if the narrative frame is stretched out of proportion by long discourses, these are lapses by a master craftsman in haste, preoccupied with an apologetic purpose but still aware that he is writing poetry.

Conclusions from such a study are by their very nature tentative. The aim of the dissertation is to lay out before the reader an account of the poem as poem. Each reader must make his own judgment upon reading the poem itself, aided--it is hoped--by the analysis. Certainly, however, any poetics which, *a priori*, excludes The Hind and the Panther because of its subject matter had better bend to its demonstrable excellences. On the other hand, those who see in form, structure, and pattern the touchstones of poetic art may find in this analysis a measure of support,

and may even enjoy the display of artistic achievements in the neglected work of an old friend.

Microfilm \$3.95; Xerox \$13.95. 307 pages.

THE OLD WHORE AND MEDIAEVAL THOUGHT: VARIATIONS ON A CONVENTION.

(Order No. Mic 61-1989)

Robert Spencer Haller, Ph.D.
Princeton University, 1960

The Wife of Bath as a character, and the stories and ideas in her Prologue and Tale, have numerous sources and analogues which have been established and generally accepted. This dissertation shows how the unity and originality of Chaucer's work depend on an understanding of these traditions of character and idea in the same literary and theological terms a Mediaeval reader like Chaucer would have used in reading them.

The dissertation first of all examines the ideas on marriage and woman to be found in Scripture, and in commentaries and literary and art works based on Scripture. Eve's desire for sovereignty and the whoredoms of the Woman on the Waters in the Apocalypse were seen as corruptions of the order of marriage, which in its perfection is modeled on Christ and the church, and on the spirit and the flesh. The Church's ideas on marriage are then traced from St. Jerome's Adversus Jovinianum to Deschamps' Miroir de Mariage. Various literary forms and techniques were developed to support, specifically, the policy of sacerdotal celibacy, and, generally, the superiority of marriage in the spirit to that marriage in the flesh which implies bondage to the world. Then follows a discussion of two conventional old women, Synagoga and the Ovidian vetula, allegorical figures quite different in their sources and literary uses, but with many resemblances based on the iconographical meanings of old age and femininity. Both figures, in their sterile and carnal old age, stand in contrast to the Church and the Virgin, who are spiritually fruitful and young in the renewal of the spirit.

Chaucer gives the Wife of Bath these traits, and also ideas and stories which ironically undercut the arguments which she tries to make. To assume the superiority of marriage to virginity, and to support the sovereignty of women in marriage, are, in Mediaeval thought, to argue for the superiority of the world, flesh, and letter to the spirit which, in orthodox thought, fulfills them through its sovereignty over them. Chaucer implies, in the Prologue and Tale as well as in other tales, that the happiness and virtue of the wives at the end of the stories is illusory because their premises are self-contradictory. The "Marriage Group" in the Canterbury Tales is Chaucer's comic criticism of certain bourgeois values which he sees as disordered marriages.

The dissertation concludes that Mediaeval literary techniques, comic and polemical, assume the reader's familiarity with figures, like the "old whore," whose meaning has been well established in earlier works, and whose ideas are consistent with this meaning and are meant to be seen from a sophisticated theological point of view. The ironies of a comic poet are much more apparent in all

their subtlety when the reader can distinguish the poet's attitude from the character's process of mind.

Microfilm \$4.90; Xerox \$17.35. 382 pages.

**FUN AND ITS CONTRIBUTORS:
THE LITERARY HISTORY
OF A VICTORIAN HUMOR MAGAZINE.**

(Order No. Mic 61-1636)

Edward Stewart Lauterbach, Ph.D.
University of Illinois, 1961

The Victorian humor magazine Fun (1861-1901) was a rival of Punch. A group of Bohemian writers, including Henry J. Byron (first editor), Francis C. Burnand, Tom Robertson, Henry S. Leigh, Clement Scott, Tom Hood (second editor), Arthur Sketchley, W. S. Gilbert, and the American Ambrose Bierce, made Fun a vigorous and lively magazine during the Eighteen Sixties and Seventies.

Under the editorship of Tom Hood, son of the poet Thomas Hood, Fun reached its peak. After Hood's death in 1874, Fun declined in literary merit, chiefly because many of the early contributors had died or stopped writing for it. Henry Sampson (third editor) monopolized the pages with his own work and that of his friend George Sims. After embroiling Fun in various quarrels, notably a lawsuit with Henry Irving during 1875-1876, Sampson and Sims left it in 1878.

The proprietors of Fun, the Dalziel brothers, known for their work as engravers, then took the editorship into their own hands. After 1878 the emphasis on the contributions changed from literary to artistic, and many artists such as Jassee Sullivan and John Houghton wrote as much material as they drew for the magazine. Not the least among the Fun contributors during the last half of its existence were the Dalziels themselves and various members of their families. The Dalziels looked on the publication of Fun primarily as a business venture, making an average profit of £3,282. They decided to sell the magazine in 1893, and after this date the history of Fun becomes obscure, though the last owner was the well-known periodical publisher George Newnes. In July, 1901, Fun was absorbed into a magazine called Sketchy Bits.

The humor in Fun was no better than the majority of nineteenth-century humor. It relied chiefly on puns and word play of the most attenuated form. But Fun, if no better than Punch, was no worse, and eventually several writers from Fun moved on to Punch (notably Francis Burnand who became editor of Punch in 1880). Fun served as a starting point for many writers of the late nineteenth century, and it deserves to be noted in literary history both as a rival of Punch and as a cradle for men such as Tom Robertson, W. S. Gilbert and Ambrose Bierce.

Microfilm \$4.20; Xerox \$14.85. 326 pages.

**THE ABATE JUAN ANDRES (1740-1817);
LITERARY HISTORIAN AND DEFENDER OF
SPANISH AND MEDIEVAL HISPANO-ARAB
LEARNING, LITERATURE, AND CULTURE.**

(Order No. Mic 61-1081)

Guido Ettore Mazzeo, Ph.D.
Columbia University, 1961

The Abate Juan Andrés was a genuine product of the erudite age during which he lived. He was able, together with scores of fellow-Jesuits living in exile in Italy during the late-eighteenth and early-nineteenth centuries, to make significant contributions to the literature, criticism, and sciences of the period, thus bringing about a more closely-knit Hispano-Italian rapprochement than had existed prior to that time. European thought and ideas were readily available to the Jesuits in exile, perhaps to a greater extent than would have been possible in their own land. Many of them, including the Abate Andrés, participated in spirited polemics in defense of Spanish learning and culture, and, together with their enlightened compatriots back in the Peninsula, helped to dispel the prejudices and misconceptions that were shared by many Europeans to the effect that Spain was a country steeped in ignorance that had contributed little if anything at all to world literature and science.

The Abate's production was highly prolific and embraced a wide variety of subjects ranging from the purely scientific to the literary and critical. His greatest claim to glory, however, was in the field of literary historiography, for he enjoyed the distinction of having written the first complete history of universal literature and science (Dell'origine, progressi e stato attuale d'ogni letteratura. Parma: Stamperia Reale, 1782-1799, 7 vols.). This ambitious and although far from exhaustive undertaking, revealed, above all, the intellectual curiosity of a typical eighteenth-century cosmopolite, who not only attempted to portray, in as open-minded, tolerant, and impartial a manner as possible, the literary and scientific achievements of all ages in the world, from primitive times to the century in which he lived, but who also chose to emphasize and bring into focus the contributions that had been made by his compatriots and the Hispano-Arabs to science and literature in Europe. The Middle Ages and the role played by the Hispano-Arabs emerge in a new perspective in the Abate's study, and an awareness of the forces that were instrumental in bringing about the Renaissance in Europe is also discernible. His analysis of modern literature and culture, which he conceived as beginning in the sixteenth century, is the most detailed aspect of his work, in which the mark of the moderate Neoclassicist predominates, but which also reveals many pre-Romanticist traits and tendencies. Comparative evaluations were frequently undertaken by the Abate Andrés, the most novel and interesting of which was his analysis of the theatre of England, France, and Spain during the seventeenth century.

Although the literary historians of national literatures were indispensable guides from which the Abate Andrés received much of his inspiration, there is every indication that subsequent literary historians and Arabists, especially those of the Romantic period immediately following the time in which the Abate lived, drew extensively from the latter's History of Universal Literature. The Abate was not only interested in revealing what the literary and

scientific achievements of the past had been, for he also sought out the means of ensuring progress in those fields in the future. Consequently, he constantly urged that scholars intensify their methods of research, and that scientists make every effort to seek out more accurate scientific procedures. Rather than the specialist, the Abate Andrés should be looked upon in the light of a popularizer of literary and scientific knowledge, whose work, although certainly not profound, was not superficial and unimportant, for it did succeed in broadening the intellectual horizons of his times.

Microfilm \$4.55; Xerox \$16.00. 355 pages.

THE APHORISMS OF WILLIAM SHENSTONE

(Order No. Mic 61-2665)

Harold Emil Pagliaro, Ph.D.
Columbia University, 1961

The reputation of William Shenstone is largely based on incomplete evidence. Although remembered as a poet, letter-writer, and gardener, Shenstone's work as an aphorist remains for the most part unknown. Yet in his aphorisms he reveals a somewhat more forceful thinker than he is generally allowed to be.

Aphoristic prose occurs in such a variety of closely related forms that no satisfactory definition of the genre (or genres) has yet been determined. Examples of these forms--brief, discrete moral precepts or general truths about a science or about human nature--have been composed by original thinkers or preserved by men of letters who culled these materials from older authors or from folk sayings. Most often, this prose tradition sought to preserve older materials. But during periods of scientific investigation--sixty-century Ionia and the Renaissance-Enlightenment in Western Europe--learned men composed original aphorisms. These original compositions fall into two major categories: expository aphorisms (about 150 words in length) modeled after the medical aphorisms of Hippocrates, or paradoxical aphorisms modeled after the maximes of La Rochefoucauld. Shenstone composed over 600 aphorisms, about half in each tradition.

Shenstone's expository aphorisms generally treat subjects on which Shenstone must have thought himself expert--gardening and taste in the arts. His paradoxical aphorisms treat ethical problems and human nature generally, subjects about which Shenstone seems to have been both less certain and more intense. The expository aphorisms are characterized by only a few telling qualities of structure: comprehensive opening sentences and pithy arguments and illustrations calculated to persuade the reader into accepting the idea in the opening sentence; but they contain little amplification. In these pieces, Shenstone's language is invariably in the middle style of Addison and Shaftesbury. The paradoxical aphorisms are most often polar; that is, they employ two grammatically balanced elements in one of several fixed relationships to each other: (1) the polar elements are antithetical, or (2) the second element synthesizes particulars in the first, or (3) the second analyzes generalizations in the first, or (4) the second is metaphorically equated to the first, or (5) the second completes a comparison begun in the first.

When Shenstone's paradoxical aphorisms are non-polar, they usually suggest antithesis by rhetorical means. All his paradoxical aphorisms require the reader to fuse disparate elements by entertaining, simultaneously, contradictory ideas, by observing "similitude in dissimilitude," or by employing, at the same time, inductive and deductive processes of thought.

Shenstone's aphoristic treatment of ethical problems draws chiefly upon the ideas of Shaftesbury and Bolingbroke. Like his antecedents, he thought of God as a Creator who had arranged a potentially orderly world of men. Theoretically, the impersonal God of this system had endowed men with the power to temper self-love with the social impulse to achieve a harmonious life. Unfortunately this accord was realized only by the sensitive and judicious few. Others distorted or were dominated by self-love and, in a variety of ways, failed to achieve the good life. In his aphorisms on aesthetics, Shenstone draws on and modifies the ideas of the sublime and the beautiful (first formulated by Addison), as well as the idea of the uncommon. In the seventeenth and eighteenth centuries, men, stirred by the sense of loss engendered by the Copernican astronomy, sought (in immensity, design, and variety in external nature) the signs of God's presence in the creation. Shenstone theorized about these natural aesthetic effects (enlarging on Addison's idea of the beautiful) and practiced approximating them in his own garden.

The stylistic force and the content of Shenstone's aphorisms, though they do not elevate him to the first rank of English authors, exalt him to a position of greater eminence than is generally allowed.

Microfilm \$2.75; Xerox \$9.25. 205 pages.

HAROLD FREDERIC: HIS DEVELOPMENT AS A COMIC REALIST.

(Order No. Mic 61-1086)

Ralph Robert Rogers, Ph.D.
Columbia University, 1961

This study delineates Harold Frederic's growth as a novelist by examining his prose fiction in chronological order; documents his gradual elimination of sentimentalism; emphasizes the comic, optimistic, pragmatic tenor of his realism as compared to the tragic, pessimistic, deterministic elements of naturalism; and attempts to define his position in relation to some of the representative literature of the period.

Frederic's life and character, which are sketched, explain his preoccupation in fiction with the young provincial whose exposure to the more complex society of the city shatters his sentimental idealism and imbues him with a more practical, realistic attitude toward life. It was not until he wrote Seth's Brother's Wife that Frederic, who belonged to the school of commonplace realism associated with William Dean Howells, found himself as a writer, first enunciated his major motif, and began to eliminate the crude sentimentalism which spoils his early short stories. He continued to be troubled by the last problem, however. A disparity exists between the hardheaded realism of Frederic's views on sex, to be found in the anonymous Saunterer articles, and the evasiveness with which he

treats the matter in his early fiction. The fidelity with which Frederic depicted the region of upstate New York constitutes the main element of realism in Seth's Brother's Wife, The Lawton Girl, and the other regional novels written before The Damnation of Theron Ware. The traces of naturalism and populism in Frederic's early social realism are slight; later on he ignored populism and repudiated naturalism.

The next group of works discussed, those published between 1891 and 1896, belong to a transitional period separating Frederic's early realism from the refined realism of his "major phase" and are generally more comic in tone. While the comic force of The Return of the O'Mahony and the social force of The Copperhead are weakened by the sentimentalism which still vitiated Frederic's fiction, he managed to develop his comic sensibility fully in the pure satire of Mrs. Albert Grundy, thereby insuring the general superiority of his later works to his earlier ones. The discussion of the comic element in Frederic's novels stresses the fault of pride in his major characters; his protagonist almost invariably figures as the Pretentious Man, comparable to the Alazon in Greek comedy, whose vanity is deflated through experience and who, as a result, moves from a foolish idealism to a practical realism.

Frederic's masterpiece, The Damnation of Theron Ware, is not--contrary to general critical opinion--primarily a study in religious satire, and it is essentially comic, not tragic, in spirit. The novel represents Frederic's period of mature realism, which was free from sentimentality. With Sister Soulsby serving as the principal exemplar, the deeply pragmatic cast of Frederic's writing is exposed and is related to the comic, optimistic, and realistic attitudes his fiction reflects. Finally, the so-called "English novels," which are less "English" and more important than they are usually considered to be, are shown to maintain the thematic continuity of the other works.

Microfilm \$3.15; Xerox \$11.05. 243 pages.

JUAN HUARTE DE SAN JUAN
AND HIS 'EXAMEN DE INGENIOS.'
A SIXTEENTH-CENTURY
SPANISH CONTRIBUTION TO EDUCATION.

(Order No. Mic 61-2568)

Richard James Schneer, Ph.D.
New York University, 1961

The purpose of this study was to define the nature of the contribution to education of Juan Huarte de San Juan, a sixteenth-century Spanish physician who was much interested in the problem of education.

The study was suggested by a review of the material available in Hispanic scholarship. Literary movements and figures of Hispanic origin are treated voluminously in the professional journals and scholarly studies. Spain's non-literary contribution to world culture, however, is relatively neglected. Huarte de San Juan is practically unknown in the United States, and his contribution to education is worthy of note.

Chapter I was dedicated to prefatory material: the need

for the study, related literature, procedures utilized in compiling the bibliography, and similar matters.

Chapter II presented the data available on the life of Huarte de San Juan.

Chapter III dealt with Huarte's work, the Examen de ingenios (1575). After a discussion of the bibliographical history of the work, categories were indicated for an analytical study. These categories were: Huarte's conception of AUTHORITY, TEACHING, WHO SHOULD BE EDUCATED, LEARNING, THE ARTS AND SCIENCES, THE NATURE OF MAN, and THE EUGENICS OF MENTAL ABILITY. Huarte's statements on these subjects were extracted from the Examen . . . and summarized.

Chapter IV was dedicated to a study of Huarte and his time. The same categories utilized in Chapter III were employed to analyze the educational climate of sixteenth-century Spain. The statements of others interested in education during Huarte's time were extracted and summarized.

Chapter V was dedicated to a review of criticism of Huarte from his day to the present. The critical statements were summarized and comment was made as to their appropriateness.

Chapter VI was dedicated to conclusions. It was found that in many respects Huarte de San Juan reflected the basic beliefs of his age. In many others, however, Huarte was far in advance of his time. Much of Huarte's thinking is as valid in twentieth-century America as it was in sixteenth-century Spain. Huarte utilized the scientific knowledge and theories of his day to formulate his hypothesis. Scientific advances since his time have invalidated many of his conclusions. His methods, however, are to be fully respected. Huarte utilized personal observation and experimentation as the only true guide to arriving at "truth."

Microfilm \$3.35; Xerox \$11.70. 257 pages.

MILTON'S SPELLING:
ITS BIOGRAPHICAL AND
CRITICAL IMPLICATIONS.

(Order No. Mic 61-2584)

John Thomas Shawcross, Ph.D.
New York University, 1958

Adviser: Walter MacKellar

Milton's spelling practices in English are determined by examination of all manuscript materials and of all published works definitely known to have been written before his blindness (1652). All orthography different from today's or showing inconsistency in the primary materials used is examined. A word list is supplied indicating variant spellings, preferred spellings, and dates of changed practice. Evidence from which spelling practices are induced is presented in tables (appendices) or in footnotes. Such a word list can serve as a guide to future editors who wish to present texts in accordance with Milton's spelling practices.

On the basis of dated spelling change, the subjects and plans of the Trinity MS. and the entries of the Commonplace Book are assigned narrowed dates of composition.

Manuscript material of uncertain authorship is analyzed according to spelling: (1) The two lines of poetry on the back of Henry Lawes' letter, corrections to a letter to Princess Sophie, an entry in a governmental order book, and a note in the PRO are concluded to be in Milton's hand. (2) Parts of the marginalia in *Orlando Furioso* may be his, but most cannot be. (3) Marginalia in *Britannia's Pastorals* and an inscription in a copy of *Eikonoklastes* are not Milton's. A *Postscript* to *Smectymnuus, An Answer*, which has been suggested as Milton's, can, according to orthography, be included in his canon of works.

Peculiar and dated spelling suggests that *Accedence Commenc't Grammar* was written before c. 1651, *Breif History of Muscovia* before c. 1651 (perhaps 1642-middle 1644), *Character of the Long Parliament* before c. 1651 (perhaps late 1648), and *History of Britain*, Books I and II, 1644-1648; Book III, summer or autumn, 1648; Book IV, late 1648-early 1649; Books V and VI, 1650. Likewise *Fift Ode of Horace* may have been composed during 1646-1651. *Samson Agonistes* may have first been planned and partly written in 1642-middle 1644, and then revised and rewritten in 1646-1651. *Paradise Regain'd* may have first been planned as a tragedy on the three Lukian temptations (Books, I, II, IV) in 1642-middle 1644, and then revised and augmented (Book III) in 1646-1651. When the epic shift occurred is indeterminant, but it may lie before 1649. Parts of *Paradise Lost* may have been written as early as 1642-middle 1644, others during middle 1644-c. 1651. The epic shift seems to have occurred before 1649; when the poem was completed is indeterminant from spelling evidence. Apparently a "corrector" familiar with Milton's practices, working perhaps from the partially extant copy or from another copy, proofread both editions. (*Treatise of Civil Power*, 1659, is used as a control.)

Milton was not especially concerned with achieving an orthographically accurate text. He did not develop a complete system of spelling, though he generally employed simplified pronunciational spellings, and his practices were often inconsistent. There is no evidence that special care was taken in producing any of the texts discussed. Milton's activities during 1642-c. 1651 must be restudied and evaluated, as should his life after 1655, as a result of the dating suggested.

Microfilm \$10.00; Xeros \$35.64. 792 pages.

A PALEOGRAPHIC EDITION OF LOPE DE VEGA'S AUTOGRAPH PLAY LA NUEUA VICTORIA DE D. GONZALO DE CORDOUA

(Order No. Mic 61-2164)

Henryk Ziomek, Ph.D.
University of Minnesota, 1961

The aim of this edition of Lope de Vega's play, *La Nueua Victoria de D. Gonzalo de Cordoua*, is to present a faithful reproduction of the autograph manuscript, supply variants which appear in four important editions of the play, and provide a critical study of this drama, including the events and personages that play a part in it.

The autograph manuscript of the play, dated October 8, 1622, has been accessible on microfilm from the Biblioteca Nacional at Madrid. The first two editions, *La Vega del*

Parnaso edited by Joseph de Villena, 1637, and *Parte 24* edited by Pedro Verges, 1641, were obtained on microfilm from the Library of the University of California, Berkeley. The last two editions, *Colección de las obras sueltas de D. Frey Lope Félix de Carpio* edited by Don Antonio de Sancha, 1777, and *Obras de Lope de Vega* edited by Menéndez y Pelayo, 1902, were obtained from the Library of the University of Wisconsin.

The changes in the autograph manuscript from each of the four printed editions are shown in this edition of the play. The words which differ in spelling in the autograph from those in the printed editions are in an index; this index shows how the spelling of a large number of Spanish words have changed various times between 1622 and 1902. The variations which occur because of addition or omission have been indicated in the footnotes of this edition together with explanatory notes on the text.

The text of the play with the footnotes appears in Part II of this edition. Part I is a commentary on the play. In the first chapter the autograph manuscript, which consists of fifty-two folios, is minutely described.

The play is a truly historical drama concerning the beginning of the Thirty Years' War, especially the Battle of Fleurus, one of the decisive battles of the war. In Chapter II, the necessary historical background is presented. For this purpose various sources have been studied, especially two books by Hennequin de Villermont, *Ernest de Mansfeldt*, vols. I, II and *Tilly ou la Guerre de Trente ans*, vols. I, II, and also *Ernest Graf zu Mansfeldt* by Ludwig Graf Utterodt. For a clearer understanding of the historical events, a map, "Belgium Under the Rule of Spain," and a chart, "The Scheme of the Battle of Fleurus," have been drawn.

The genealogical relation of the title hero of the play, Gonzalo de Córdoba, to the Great Captain Córdoba is traced in Chapter III. Both of their biographies are included, and some attention is given to the Great Captain's contribution to Spanish military strategy, the *tercios*.

In Chapter IV, it is shown how Lope de Vega's relationship to the historical figures relating to the play, the Infanta Isabel and don Luis de Córdoba, influenced him in writing this play. The historical criticism, which follows, points out that Lope de Vega followed a chronological account of the war. An analysis of the dramatic techniques employed in the play shows that the play was written in the genre of the *comedia de capa y espada*. Lope's use of the popular old ballads and his poetic language are also discussed. Two tables of versification are drawn to show the structure of the drama, and previous criticisms and actors of the play are mentioned.

A selected bibliography of materials related to this play concludes this edition.

Microfilm \$3.35; Xerox \$11.70. 260 pages.

**LANGUAGE AND LITERATURE,
LINGUISTICS**

**LINGUISTIC CLASS-INDICATORS
IN THE SPEECH OF DICKENS' CHARACTERS**
(Order No. Mic 61-2813)

Robert Bruce Glenn, Ph.D.
University of Michigan, 1961

This is a study of nine Dickens novels that are centered around nineteenth century London---Nicholas Nickleby, Old Curiosity Shop, Martin Chuzzlewit, Dombeey and Son, David Copperfield, Bleak House, Little Dorrit, Great Expectations, and Our Mutual Friend. It is an attempt to integrate linguistics and literature, and thus acquires a dual purpose. The linguistic purpose is to make a descriptive analysis of the language of the lower class characters in the novels, and to show its relationship to the actual language spoken by the lower classes of London in Dickens' time. The literary purpose is to show that Dickens used the language extensively, and that he used it with conscious aesthetic intent.

In chapter II, the characters in the novels are assigned to social classes. To prevent the assignment of characters to classes simply by impression or convenience, and to avert the circularity of examining as "lower class" the language of characters originally assigned to the lower classes because of their language, two methods of class determination outlined by William Lloyd Warner in Social Class in America (1957) have been adopted, with some modifications, since these methods afford considerable objectivity, and since they are independent of the language. This makes it possible to establish an Index of Status Characteristics for characters if three variables---occupation, house type and dwelling area---are known. Once this has been done, it is possible to establish by projection an Index for a number of other characters, when only two of these variables are known. The remaining characters are placed in social classes by Evaluated Participation, the other method outlined by Warner; in this method, such techniques as symbolic placement and institutional membership are employed. At this point it is possible to identify three groups of characters: a group that is clearly lower class, a group that is clearly not lower class, and an ambivalent group in which the characters have affinities to both of the first two groups.

The actual language of the lower classes in London during Dickens' time is described in chapter III; this language is conceived as Received English with a series of variations, rather than as an entity. The variations are recorded from 25,000 running words of transcriptions of lower class speech, and from comments upon the language by Dickens' contemporaries. In all, there are sixty-three categories of variations: twenty-four of phonology, eighteen of morphology, two of morphophonemics, seven of grammar, and twelve of function words.

In chapter IV, the language variations in chapter III are used as a basis for describing the language of the lower class group and the ambivalent group identified in chapter II. Chapter IV comprises five statements of distribution:

- 1] the different characters that speak items from the categories in chapter III.
- 2] the different characters that speak items from twelve categories not found in chapter III.

- 3] the number of characters speaking items from each category.
- 4] the characters having no variations from Received English.
- 5] the different categories used by each speaker.

These statements of distribution permit the following observations:

- a] the total number of variations is not as important as the categories from which these variations come, or as the number of different appearances in the novel in which a category is used by a character.
- b] there is a core of about thirty categories which Dickens uses at random.
- c] there are some variations of which Dickens makes only token use.
- d] there are a few categories that are used extensively by only certain speakers; in many cases, only one character in an entire novel will speak items from a category, and yet he will use the category in several appearances.

The last observation makes it quite clear that Dickens has been, at times, highly selective in endowing his lower class characters with language---so selective that the language becomes an integral part of the character. This permits the reader an additional means of identification with these characters, and permits Dickens an additional means of controlling his reader's reaction.

Microfilm \$3.00; Xerox \$10.35. 230 pages.

**PHONOLOGY, MORPHOLOGY AND VOCABULARY
IN THE LANGUAGE OF JUAN DEL ENCINA**

(Order No. Mic 61-1084)

Oliver Tomlinson Myers, Ph.D.
Columbia University, 1961

A study of the phonology of Juan del Encina's standard literary language reveals certain phenomena of interest in the history of the Spanish language. There is some evidence that in Encina's language the phoneme represented by v may have been a voiced bilabial fricative. The /s/-/z/ opposition was not always maintained in certain classical names (e.g., Jassón for the usual Jasón). Encina evidently pronounced /s/ in all words in which x was written, whether of popular or learned origin, judging by his rhymes. The aspirate /h/ in a few very common words with initial h (< Lat. F) apparently was weakened in Encina's speech, permitting synalepha in poetry. The sequences /ie/ and /ue/, representing a popular development from Lat. E and Ó, are invariably monosyllabic in Encina's poetry; the sequences /ie/ and /ue/ from Lat. I(D)E and U(D)E are generally dissyllabic, suggesting that such combinations were dissyllabic in his speech.

The principal phonological features of the language of Encina's rustic characters are the use of /h/ (< Lat. F) in words which have /f/ in standard Spanish, the use of /l/ in certain words which have /l/ in standard Spanish, the use of /n/ in señor, the use of /n/ for /n/ and of /r/ for /l/,

and the phenomena of metathesis and apocope. Peculiar to the Auto del repelón are the following: the use of /e/ for /ie/ in certain learned words, /o/ for /au/ in aun, aunque, /u/ for /o/ in pretonic position (alternation of /i/ and /e/), and of /o/ and /u/ is common in all of Encina's writings), and paragoge.

The orthography of the 1496 Salamanca edition of Encina's Cancionero is remarkable for its modernity and consistency. No examples of alternate spellings with b/y, ç/z, x/j are found and few with s/ss. The only major area of inconsistency is the problem of silent h (e.g., edad/hedad, Omero/Homero). The written accent is used fairly often, unlike most contemporary printed books, in which it is almost unknown; it is used principally to show stress in verb forms and in foreign proper names.

The morphology of Encina's standard literary language shows only a few characteristics worthy of note. He makes a clear distinction between le as direct object pronoun referring to masculine persons and lo for masculine things. His use of the superlative absolute -ísmo shows a high frequency for his time. Only a few exceptional verb forms are found (e.g., quier, quies; vido as pret. or past part.).

In the dialectal writings, many morphological features clearly mark the distinction between Encina's standard and his rustic usage. In the verb the noteworthy features are: 1) present tense: frequent apocopation, use of second plural endings -ás, -és, and the form sos (from ser) used with either tu or vos; 2) preterite and related tenses: hu, huste (for fue, fueste); peculiar to the Auto del repelón are analogical third plurals, i.e. third singulars plus final -n (e.g., pudon formed on pudo), the third plural ending -oren for regular -ar verbs, and apocopated future subjunctives (e.g., creyer); 3) imperative: the plural imperative regularly omits final /d/ in all dialect writings. There are certain adverbs, prepositions, conjunctions and pronouns that are found only in dialect. The prefix per-, attached freely to a variety of words as an intensive, is a feature of dialect, but is not found in the Auto del repelón. Augmentatives are especially common in the Auto.

A glossary of some 440 words has been prepared according to the following criteria. It includes: 1) those words found in Encina but not listed in the latest edition of the Dictionary of the Spanish Academy; 2) words which are used by Encina only in his dialect passages and which seem to be intended to mark the dialectal nature of those passages; 3) words whose earliest documentation has been given (e.g., by Corominas) as being later than Encina; 4) certain words pertaining to farming or to the pastoral life in general; 5) specialized terms from certain professions and occupations; 6) certain Latinisms and other borrowings. Separate lists are given classifying a number of words into certain of the above categories.

Microfilm \$3.60; Xerox \$12.60. 277 pages.

A LINGUISTIC ANALYSIS OF WORDS REFERRING TO MONSTERS IN BEOWULF

(Order No. 61-2987)

Stanley Marvin Wiersma, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor F. G. Cassidy

Two problems that have long vexed scholars of OE literature are the dating of Beowulf and determining whether the poem is a unity. Speculations on date by reputable scholars range from the seventh to the tenth centuries. The controversy concerning unity centers in whether or not the dragon episode is of a piece with the rest of the poem.

The method of investigation included four steps: (i) Each word referring to monsters was abstracted from Beowulf. (ii) For each of these words an etymology was provided. (iii) A history of the occurrences of the word in OE literature was provided. (iv) The history of the word since prehistoric times was compared with the use of the word in Beowulf.

The evidence gathered concerning the problem of date, while it does not conclusively prove the validity of an early eighth-century date for Beowulf, is certainly not sufficient to warrant a change from that conventionally held date.

The evidence gathered on the problem of unity demonstrates that a major cleft occurs between the episode dealing with Grendel and Grendel's mother and that dealing with the dragon. Grendel and Grendel's mother are referred to by words which demand explicit diabolical interpretations; the dragon is not referred to by such words. If the dragon's diabolism is a reality, it is implicit.

One of the more valuable aspects of the study is its reinterpretation of numerous passages in Beowulf in the light of etymology and in the light of uses of specific words in OE literature outside of Beowulf.

Microfilm \$6.50; Xerox \$23.20. 512 pages.

LANGUAGE AND LITERATURE, MODERN

SIX NOVELS OF WILLA CATHER: A THEMATIC STUDY.

(Order No. Mic 61-2814)

Theodore Stanford Adams, Ph.D.
The Ohio State University, 1961

The dissertation studies Willa Cather's rather complex values as embodied in six of her major novels. Dominating her interest are pioneers, artists, and religious seekers. She examines unusual persons responding variously to society, nature, the past of the individual and of history. Nature is important in My Ántonia, where the conquest of land is paramount; nature as backdrop in A Lost Lady assists definition of main characters; in My Mortal Enemy and The Professor's House, nature as religious emblem is crucial to the heroes. Constantly experimenting with form, Cather uses such traditional devices as character-grouping

and auctorial aphorism to show that simple virtues, loyalty and courage, for example, are significant but must stand beside intellectual depth.

Two important novels emphasize the pioneer West. Characters in My Ántonia, tested almost solely by their acceptance of the Nebraska prairie, bow to circumstances yet successfully tame the land. In Death Comes for the Archbishop, comprehension of Southwestern surroundings, rather than acceptance, is the test, but circumstance and character again interact. The past is complex. For Ántonia, the Bohemian past, her prairie life, and the long prairie history live on through her children. For the archbishop, ideals spring from the Spanish, the American Indian, the French, and, most important, the Roman Catholic inheritance. Boundless possibility in My Ántonia tends to dwarf achievement; in Death Comes for the Archbishop, fulfillment towers over human imperfection.

Another pair of novels portrays artists--a singer and a frail artist-at-living. In The Song of the Lark, the town opposes the singer and her intensity. Creating her past, Thea Kronborg learns from many sources, including a decadent modern city and a beautiful, ancient settlement. (These social polarities are to be more significantly contrasted in The Professor's House.) In struggling continually against her own limitations and the misunderstanding of almost everyone around her, the heroine finds satisfaction but grows increasingly ruthless. The heroine of A Lost Lady is more strongly condemned by her town, and the town more harshly criticized by Cather. Marian Forrester fails as artist and human being. Her pioneer husband is her source of values, and though she finally grasps the connection between his manners and his heroism, she loses her first brilliance.

My Mortal Enemy describes Myra Henshaw's pursuit of worldliness and of spirituality. She is early associated with bright conversations and beautiful settings; later, her surroundings are lonely and sordid. Violently rejecting her devoted husband, longing for riches, she nonetheless intensely seeks religious truths in the starker aspects of nature; she is a convincing unresolved paradox.

The Professor's House places Godfrey St. Peter's spiritual search against the corruption of six societies (by implication, all societies), including a prehistoric city and the petty-officialdom of Washington, D. C. Despite his generosity, the professor acknowledges this corruption; despite his loyalty, he rejects his family. In nature he achieves a vision of decay, death and rebirth which may apply to both individuals and societies. Thus Cather suggests for the first time a resolution of opposing tensions.

Thematic effectiveness in My Ántonia is marred by sentimentality, in The Song of the Lark by excessive detail and weak plotting. A Lost Lady and My Mortal Enemy are weakened by abrupt changes of pace in concluding pages. With the free but controlled plots and narrative centers of Death Comes for the Archbishop and The Professor's House, Cather succeeds. The latter novel, a skilfully elaborated thematic complex, is her best.

Microfilm \$3.25; Xerox \$11.50. 251 pages.

JOSE ENRIQUE RODO:
HIS IDEAS ON AESTHETICS.

(Order No. Mic 61-2733)

Cecil Clifton Bacheller, Ph.D.
University of Michigan, 1961

José Enrique Rodó's contribution to Hispanic American intellectual life at the turn of the century was great and his influence continues to be felt today. Throughout his works, an appreciation of beauty is obvious. This dissertation attempts to outline his development as a thinker and to juxtapose some of his ideas related to aesthetics. These ideas, significant to his whole thought, are scattered throughout his writings, and are usually stated indirectly and elaborately.

Part I treats Rodó's works, his personality, and critical attitudes toward him, now impartial, following periods of adoration and exaggerated adverse criticism. His several works are characterized, beginning with far-sighted articles near the end of the reign of Positivism and including his master work on the vocation. Chapters II and III concern Uruguayan thought from 1850 to 1917 and Rodó's emergence out of Positivism into an axiological, anthropocentric Idealism. Much attention is paid to the early conflict between the eclectic spiritualists and positivists. At the end of the century, the rise of Idealism coincided with the emergence of Rodó who, without ignoring his positivistic background, emphasized the spiritual nature of man and the development, through experience, of ideals inherent in each individual, ideals freeing man from physical coercion.

Next, the mass of diversified reading Rodó incorporated into his thinking is indicated. Similarities of thought are shown between the Uruguayan, his French contemporaries, and classical writers.

Part I concludes with one of Rodó's main themes, the vocation. He presents man as enduring in psychic time, persisting in the continuance of his modifications, and fulfilling his destiny only when man orients, guides, and directs his modifications. Rodó believes that the individual, by analyzing and developing his innermost self and by modifying but not destroying his real personality, will arrive at an awareness of his vocational calling and of his potentialities.

Part II concerns Rodó's ideas related to aesthetics, ideas again stressing the role of man, of his life, and of lo real in art and beauty. Rodó sees beauty as a fantasy within man's consciousness and art as the expression of lo bello of the spirit in all its activities. Beauty, again, born at the death of usefulness, is an impulse of the will to emancipate itself from the forces of reality. Its expression in art, which inserts itself into reality and constantly modifies itself, becomes a subjective idealization of reality.

Rodó also shows an exact relationship between aesthetics and ethics, and points out the mutually beneficial relationship between art and society and culture.

In artistic creation, he places much faith in the unconscious as a depository where works of art lie awaiting development, and as an inventive force in itself. He describes the conciliation of reflective thought and unconscious intuition in the creative process and the transformation of artists into the world of dreams. He believes

the critic resembles the artist in undergoing interior battles, and should participate emotionally with the object of his contemplation.

In viewing the arts in Hispanic America, the Uruguayan critic feels that artists there had not profoundly interpreted their own surroundings, a step toward arriving at universality, and had followed Europe's artistic lead too closely. As for Modernism, he was first impressed by it but he became discouraged when he found that the imitators of Rubén Darío were not expressing their own personality, that there was a lack of human content in Modernism, and that it was turning away from truth and toward the exotic.

The conclusion points out that Rodó, the individual, represents unity, and, at the same time, multiplicity, both in himself and in his ideas. In spite of seeming diversity in the breadth of the man and his writings, there is a unity within the man, within his thought, and between the man and his counsel. With infinite faith in man and his potentialities, Rodó himself was the living embodiment of his doctrines. His ideas, including those on aesthetics, are quite typical of interests at the turn of the century, but he gives those thoughts a new inflection and makes them live through beautiful expression.

Microfilm \$2.75; Xerox \$8.80. 193 pages.

**THE BASIC IDEOLOGY
OF JOSÉ ORTEGA Y GASSET:
THE CONFLICT OF MISSION AND VOCATION.**

(Order No. Mic 61-1018)

Ida Blanche DePuy, Ph.D.
Stanford University, 1961

The Spanish philosopher José Ortega y Gasset (1883-1955) is a controversial figure often ignored or misinterpreted by critics among the religionists, political adversaries of left and right, and professional intellectuals. His basic ideas, frequently disguised by a seductive literary style and habitual use of journalistic media, were never expressed in systematic form nor, until recently, organized in thematic units. These ideas have strict internal coherence, grouped around a limited number of themes. Keys to understanding his thought are the concepts of authenticity and vocation which constitute the ethical basis of his thinking.

As intellectual leader of his generation, Ortega felt he had the mission of leading his country back to intellectual respectability, technical competence, and moral responsibility. His efforts necessarily took on political significance. When action at a practical level was required, however, Ortega retreated into theoretical preoccupations. Apparently never solving the problem of commitment, he declared his vocation to be that of intellectual and philosopher and defined the philosopher as "engaged" only in defending the right of theoretical thinkers to remain uncommitted. Thus his vocation conflicted essentially with his prophetic, didactic mission.

A survey of Ortega's biographical background is necessary not only to trace this conflict but also because of the importance in his thinking of la circunstancia--the cultural, historical and social atmosphere in which each individual is uniquely enveloped and with which he must do battle.

Other important philosophical ideas are his perspec-

tivist concept of primary reality (ultimate reality being knowable only by God) as la vida de cada cual, his definition of individual being as the interaction of the subjective self with the objects, ideas and events which form its circumstance (yo soy yo y mi circunstancia), and his notion of a narrative form of reason which he calls la razón vital-histórica-viviente.

In his sociology Ortega describes two levels of social life--the interindividual contact of interpersonal relations, and the relationship of the individual to the impersonal, dehumanized collectivity. He develops concepts of self-selected minority and irresponsible mass-men, sportive ideas versus serious creencias (the unquestioned suppositions on which life rests), and binding social usages enforced by the powerful opinion of the collectivity.

In his consideration of history and historiography, Ortega proposes the generation as the agent of cultural change and develops such ideas as la altura de los tiempos, crisis versus form, the sportive sense of life and el lujo vital. His educational theory and proposed reform of the university parallel but precede certain developments of General Education.

Ortega's ideas on the nature of art and literature, the mission of the artist and poet, and the role of the critic follow logically from his philosophical and cultural pre-occupations. Special interests in both fields--el lado psíquico-biológico del arte, for example, and his theories on the literary genres--show the range and scope of his work in these areas.

The effectiveness of Ortega's insights and contributions will depend largely upon the work of his school in completing and implementing his concepts. In his life-time he raised the general level of his country's intellectual endeavor, reopened the Spanish border to European ideas, stimulated Hispano-American and Anglo-Saxon thinkers and provided common ground for their rapprochement. The success of his didactic mission may, however, depend upon a change of psychological climate in Spain.

Microfilm \$5.00; Xerox \$17.55. 390 pages.

**WILLIAM DEAN HOWELLS
AND HIS RELATIONSHIP WITH THE ENGLISH:
A STUDY OF OPINION
AND LITERARY REPUTATION.**

(Order No Mic 61-2612)

Joseph Albert Dowling, Ph.D.
New York University, 1958

Adviser: Professor W. M. Gibson

William Dean Howells's earliest feelings toward the English were hostile, and it was many years before he came to feel truly affectionate toward the "land of his ancestors." There can be little doubt that the Welsh background of his family contributed to his suspicion of the English and this childhood antagonism was reinforced both by Howells's experiences as American consul in Venice during the Civil War and his unfortunate meeting with Anthony Trollope. His deep involvement in the struggle for realism and his bitter attacks upon such giants as Dickens and Thackeray led to acrimonious exchanges

with the British critics, but Howells's attitude toward the English became less severe as time passed and the battle for realism abated. Friendships with individuals like H. G. Wells, Edmund Gosse, and David Douglas did much to soften his animosity, and his growing awareness and appreciation of the values of many of the British institutions tempered his deep-set opposition to British aristocracy. He particularly admired Britain's valiant leadership against what he considered the dangerous imperialism of Germany. Howells's later letters and travel books show clearly that time and experience greatly modified his earlier opinions of England and English literature.

Howells's early travel books, Venetian Life and Italian Journeys, and his novels from Their Wedding Journey through Dr. Breen's Practice firmly established him in the critical esteem of the British. His novels from A Modern Instance to An Open-Eyed Conspiracy include much of Howells's best work, and many English critics came to regard him as America's outstanding man of letters. Several of the reviewers revealed a deep and sympathetic understanding of Howells's work, and consistently emphasized the distinctive Americanism of his writing. Both The Rise of Silas Lapham and A Hazard of New Fortunes were recognized as major novels, and The Rise of Silas Lapham was greeted by the most laudatory reviews that Howells was to receive from the British periodicals.

The importance of Howells's position in English critical circles during the last two decades of the nineteenth century is further evidenced by the number of individual articles devoted to his fictional methods and ideas. These articles are valuable not only for their shrewd analyses of some aspects of Howells's fiction, but also for their revelation of the attitudes and prepossessions of the English critics. These attitudes are further clarified by the violence of the British reaction to Criticism and Fiction. In reviewing this work the British critics expressed their particular and often opposing theories of fiction, as well as their resentment of Howells's barbed, and sometimes unjust, attacks upon England.

Howells's later travel books and his novels from The Story of A Play to The Leatherwood God, were very favorably received in England, although it was generally felt that these did not equal his earlier works. Nevertheless, he was applauded for his portrayal of American and Americans and for his battle to save American fiction from the "banal, commercialized" level to which it fell at the close of the century.

It is evident that Howells's reputation in England rose steadily from the publication of Venetian Life, and reached its height in the last two decades of the nineteenth century. Thereafter his fame declined until at the time of his death Howells was virtually unknown to the reading public of England. The warmth of his reception in England establishes beyond any doubt Howells's importance as an interpreter of the American scene, and attests to his stature as an advocate of the "New School of Fiction."

Microfilm \$4.15; Xerox \$14.65. 323 pages.

THE DRAMATIC TECHNIQUE OF LUIGI PIRANDELLO.

[APPENDIX NOT MICROFILMED AS A PART
OF THE DISSERTATION.]

(Order No. Mic 60-4939)

Thomas A Erhard, Ph.D.
The University of New Mexico, 1960

Chairman: Willis D. Jacobs

The plays of Luigi Pirandello (1867-1936) are undergoing a renascence in American theatres. Nineteen of his forty-four plays have not been available in translation, however, and the criticism of even the better-known works is limited. Appended to this study are three new translations of Think It Over, Giacomino!, Cap and Bells, and But It's Only a Joke. Some critics call him a great thinker; others, merely a trick playwright. Some call him a great dramatic craftsman; others, a poor one. Some think of him as a novelist; others say his stories are most important, and still others value only the plays. He has not been fully understood, and too many critical generalizations have been accepted in lieu of close study of all his texts. Fortunately, the criticism has shown signs of maturing. Fiskin led the way by observing that Enrico IV and Six Characters were not trick plays but were great stories of suffering. Bentley, carrying on from that point, has stressed the human isolation in Pirandello's plays.

To understand Pirandello fully, one must observe how he moved past Verga's realism and added elements from both the old commedia dell'arte and the modern grotesque theatre. All three types are seen in his early play, Think It Over, Giacomino! One should also be familiar with his untranslated essay, L'Umorismo. Not only is Pirandello's interest in the Hegelian concepts of relativity and the constant flux of life seen in the essay, but also his development of Hegel's theory of comedy. Pirandello believed that life should be portrayed objectively. Literary art, he added, was a blending of the emotional impulse with the reflective power. If either aspect predominated (as in his own plays, But It's Only a Joke, and Rules of the Game, respectively), the literary quality of the work suffered. Pirandello was also concerned with his "theatre of the mirror" in which characters suddenly perceived their own absurdity and then needed to cover themselves with a protective layer. This process he called costruirsi, one of the fundamental tenets of his art. It is seen in Cap and Bells; Ciampa understands his own ridiculousness and must, therefore, maintain at least an outer cloak of respectability before the villagers.

Most of Pirandello's plays evolved out of his own earlier short stories. In many instances he began with an episodic prose vignette and then used its key scene almost intact in the later play. Think It Over, Giacomino! is one of several examples. In addition, the story is unresolved, whereas the play comes to a strong dénouement. The play adds several important characters including Cinquemani and Father Landolina, it has much stronger conflict than the story, and it exhibits Pirandello's important theme of the refusal of society to stay out of an individual's private affairs. Right You Are is another play far superior to its antecedent short story. The play contains several vivid scenes, but the story has none; the play is resolved, the story is not; the play shows the savage curiosity of the townspeople, but the story does not develop this serious theme.

Part of Pirandello's greatness lies in his theatrical inventiveness. His trilogy of the theatre, Six Characters in Search of an Author, Each in His Own Way, and Tonight We Improvise, all extended the boundaries of theatrical art by breaking away from conventional fourth-wall realism. Six Characters, most important of the three, is an excellent blend of farce and tragedy, a type becoming more prominent today among serious playwrights. Six Characters also exhibits the many Pirandellian themes and techniques at their best.

Even more of his greatness can be found in his "message" to modern man. His major themes are the stifling of the sensitive individual by society, the impossibility of privacy today, and the utter isolation of the individual. Though Pirandello did not attach Mussolini's regime in Italy, his plays reveal him to have been in strong opposition to the basic principles of Fascism. In addition to his contributions to stagecraft, his works remain topical and important today, as the world seems moving toward increased mechanization and dehumanization.

Microfilm \$2.95; Xerox \$10.35. 227 pages.

**JOHN DRYDEN'S USE OF THE CLASSICS
IN HIS LITERARY CRITICISM**

(Order No. Mic 60-4756)

Mary Thale Gallagher, Ph.D.
Northwestern University, 1960

Abstract not available.

Microfilm \$3.20 Xerox 11.05. 245 pages.

**STEFAN ZWEIG'S NOVELLEN -
AN ANALYSIS**

(Order No. Mic 61-2764)

Randolph Jerome Klawiter, Ph.D.
University of Michigan, 1961

Known primarily for his biographies of historic figures, Stefan Zweig was also gifted as a lyric poet, a dramatist, a translator and a writer of Novellen. While a considerable amount of scholarship and literary criticism has been devoted to an evaluation of his total work and specifically of his biographies and biographical essays, relatively little has dealt with his Novellen. To be sure, the Novellen have been discussed in a cursory manner in the biographies of Zweig, and have enjoyed a number of appreciative reviews, but to date no comprehensive treatise on his fiction has been forthcoming. A critical discussion of his narrative prose is, however, necessary if we are accurately to appraise the creative efforts of one of the great modern literary artists of the German language. To fill this gap at least partially is the intent of the present effort.

In as much as Zweig's Novellen are not merely literary products suspended in an aesthetic vacuum, but are rather intimate, personal expressions it appears that an accurate evaluation of the narratives demands that their author be

placed, at least initially, in the foreground. Therefore, a relatively extensive biographical résumé of Zweig's life and literary activities serves as Chapter I.

Chapter II approaches Zweig's Novellen from a general structural, stylistic and linguistic point of view. It is by means of his style that Zweig sought to create the external and internal image of living individuals, but above all to imbue their emotional and psychic experiences with a high degree of psychological veracity and some degree of plastic realism.

Chapter III contains a discussion of the Novellen as total units. Two general characteristics are immediately evident when the Novellen are considered as a totality: first, they reveal a definite stylistic development in Zweig, from a lyrical neoromantic beginning to a metaphysical realism in his last work; and second, they seem to follow the same basic scheme that Zweig used in his biographical studies wherein typical human character types are driven forward by inner compulsive drives toward predestined goals. The present discussion, however, concerns itself more with the Novellen as individual units portraying a whole range of emotional actions and reactions. These emotional crises can, to be sure, be interpreted as evidence of specific human character-types, which, under given circumstances, have universality of application. However, it is only in their individuality that they assume artistic and, consequently, personal merit. The interpretations offered, therefore, stress the Novellen more as individual units, each seen as a particular stage of the emotional growth in the human being, rather than variations of one and the same daemonic urge.

The autobiographical aspects in Zweig's Novellen serve as the central theme of Chapter IV. This approach is based on the view that no work of literary art is the product of pure objectivity — it is on the contrary an expression of something by someone, both factors so inextricably bound together that to separate the two is to have neither. If this is so, it must follow that Zweig could not help but reveal his inner convictions and aspirations in his writings. This does not mean that the author must personally experience the events portrayed, but rather that he understands their probability and can appreciate and evaluate their reality.

Microfilm \$3.55; Xerox \$12.40. 275 pages.

**LATE VICTORIAN JOURNALISTIC CRITICISM:
A STUDY OF GOSSE, LANG, SAINTSBURY,
AND CHURTON COLLINS.**

(Order No. Mic 61-2837)

William Roberts Matthews, Ph.D.
The Ohio State University, 1961

The purpose of the study was to investigate the range of literary criticism printed in British magazines and reviews during the last two decades of the nineteenth century by focusing on the work of three popular critics--Gosse, Lang, Saintsbury--and one peripheral one--Churton Collins.

Criticism was printed in about all the periodicals and newspapers with middle- and upper-class readers. Contemporary criticism of the genre and the work and practice of some major critics--Arnold, Pater, Wilde, Henley,

Dowden, Dobson, and Birrell--show that criticism was becoming more impressionistic and more individual as well as more informal as the century closed.

The four critics of the study had in common a faith in literature and in its value for the common man. Thus they tended to be popularizers. Gosse, aside from feeling that he was a "high priest" in the service of literature and that a critic should use a man's biography to explain his art, had few theoretical grounds for his judgments. Lang, basing his work on his own tastes for light and romantic literature, had no patience with realism. He followed Daudet and Wilde in believing that criticism was a record of the soul in the presence of masterpieces. He also doubted that criticism had much real value as a servant of letters. Saintsbury, influenced strongly by Pater, maintained that a critic should find a writer's "formula," account for the impression of the art, and keep an open mind about all literature. Style, "the poetic moment," is the critic's best and safest concern. Collins, while not discounting the pleasure principle, was most interested in criticism as an organ of education in morals, ethics, and politics. He felt the critic should be a teacher and a scourge to second-rate critics. Swinburne, he was sure, had turned criticism into a "lyrical cry."

Gosse and Saintsbury felt style to be the crucial element in a poem. Lang felt that poetry should be "manly," "light," or "gay." Collins was interested in the didactic.

Gosse believed the future of the novel lay in a fusion of romance and realism; Saintsbury that the novel as a description of social life was forced to use more and more restricted materials and that "romance" with its "universal" subject matter would take its place. Lang, a maker of reputations for novelists like Haggard and Stevenson, preferred light romantic, adventure-laden fiction and had no patience with realism and "psychologizing."

Gosse saw in Ibsen and the Danish National Theatre an example of what drama might again be in Britain. Collins published one book on Shakespeare, mainly comparative scholarship mixed with attacks on other critics.

Lang wrote several brief appreciations of French literature, Collins some scholarly biography. Gosse, a staunch champion of continental literature, tended to judge this writing in British terms. Saintsbury, the recognized late nineteenth-century expert on French literature, concerned himself with discovering the unique stylistic qualities of French writers.

With the exception of Collins, each critic followed Sainte Beuve by including biography, anecdote, and somewhat tentative judgments in their essays and causeries. Collins and Gosse wrote in an oratorical style; Lang and Saintsbury more nearly approximated the prose rhythms of normal speech. Gosse's tone was the imaginative one on the novelist, Lang's the discursive imagination of the familiar essayist; Saintsbury's of the intellectual talker, and Collins' the clear coldness of the hard-working scholar. There is some evidence that the style of each was affected by the journals in which they published.

Microfilm \$2.90; Xerox \$10.15. 222 pages.

**DRAMA AND POLITICAL COMMITMENT:
THE IMPACT OF POLITICS
ON AMERICAN DRAMA OF THE 1930'S.**

(Order No. Mic 61-2842)

Gerald Edward Rabkin, Ph.D.
The Ohio State University, 1961

British and American critics have recently affirmed either the virtues or the liabilities of political commitment for the artist. For the purpose of clarifying the contemporary debate, this study examines the problem of political commitment in terms of the 1930's, a period in American history universally considered "committed," which was intensely concerned with the problem. We have further concentrated our attention upon the drama, because the drama, by its very nature an immediate and public art, most clearly reflected the problem manifest in all art of the 1930's.

In order to clarify the problem of political commitment, this study examines three broad theatrical developments central to the theme--Theatre Union, the Group Theatre, and the Federal Theatre Project--each of which represented a different degree of political involvement. In addition, it considers in detail five representative and important playwrights of the period--John Howard Lawson, Clifford Odets, S. N. Behrman, Elmer Rice, and Maxwell Anderson--who collectively reflect the dominant and characteristic reactions to the problem. Out of these investigations we have endeavored to determine the consequences of the commitments of groups and individuals in relation to the dramatic genre.

On the basis of the evidence certain conclusions become apparent. First of all, the act of political commitment was not primarily volitional for the dramatist; he was politically involved because the conflicts of the 1930's seemed to demand resolution. The work of each of the theatre groups and playwrights we have examined demonstrates the prevalence of political concerns. However, the esthetic consequences of specific political obligations were not always uniform. If the cases of Lawson and Theatre Union demonstrate the liabilities of political commitment, the cases of Odets and Behrman reveal that their major work was precisely that which was most politically involved. The crucial factor seems to be the fundamental relation of the dramatist to his commitment: whether his political commitment is superimposed upon his art or whether the organic structure of his work is dependent upon his political convictions.

Microfilm \$5.85; Xerox \$20.75. 460 pages.

A STUDY OF THOMAS FULLER'S WIT

(Order No. Mic 61-2650)

Robert Benjamin Resnick, Ph.D.
New York University, 1961

Adviser: Professor J. Max Patrick

Seventeenth-century criticism concerning a definition and history of wit tended to be incomplete and imprecise. Although writers about Thomas Fuller agree in crediting

him with wit, they fail to recognize that they must look to Fuller's practice for his definition of wit. This dissertation (1) defines Fuller's wit to see what connection there is, if any, between him and the theorists; (2) on this foundation, examines the devices he uses to achieve different types of wit; (3) discusses their function.

A review of what Thomas Hobbes, Abraham Cowley, John Locke, and John Dryden say about wit reveals that the term, as used from 1650 to 1700, meant anything from fancy to propriety, from the gathering of similitudes to reason. Fuller's wit may be defined as a reaching towards truth and morality through the use of such devices as antithesis, aphorism, play with words and phrases, understatement, the retort, parallelism, allusions, and homely and other imagery.

Fuller uses wit chiefly for emphasis, for attack, and for defense. Distortion is nearly always involved: To emphasize what he regards as a truth, he heightens a contrast or lessens a similarity, often reinforcing them with alliteration and parallelism. In attacking an opponent or a falsehood, he is not content to rest with mere statements of fact and reasoning based on them, but he resorts to persuasive and pointed distortion, sometimes exaggerating to absurdity, sometimes defaming by reducing what is attacked to pettiness, sometimes transforming it by exposing or manufacturing an incongruity. His wit of defense is similar, depending likewise on distortions either of language or of content. The essence of his wit here resembles that of the Metaphysical poets: At its heart it is a dislocation, a twisting, a distortion based on subtle or obvious changes of emphasis, the bringing out of incongruities, the heightening of disparateness or similarities or both, or the reduction to insignificance. He employs standard rhetorical devices to these ends, and does so with exceptional shrewdness in application. Thus he makes use of antithesis to convey a lesson at a glance, to indicate incongruity, or to heighten contrast. His understatements and exaggerations bring out incongruities. If he has no better means, and even when he need not do so, he defends himself by means of word play, especially when he wishes to moralize, to chastise his opponents, or to ridicule their assertions or actions. One of his favorite methods is to pose a question in such a manner that his retort to it reduces the query to obviousness or the ridiculous. Parallelism of words and meanings likewise is used to expose the ludicrous or to evince similarity in what seems dissimilar. On the other hand, when he wishes to make a truth vivid and the wit of distortion would be unapt, he utilizes the wit of brevity: Thus he resorts to well-turned aphorisms for summary statements, as preceptual truths to head paragraphs, and as reinforcements of truths already divulged.

One chapter is devoted to an analysis of Fuller's witty use of Biblical allusions, homely images, and the like: This examination reinforces the conclusions already drawn and adds to them.

In the minor works the devices of wit are still used to achieve and reinforce meaning. Fuller arrived at wit of association by making use of the proverb, the traditional belief, identification of names, and the homely image. The wit of ingenuity, which focuses on the meaning Fuller intends to give, is achieved by incongruity, elaboration, and the finding of the dissimilar in the similar. Fuller employed his devices of wit to achieve truth and morality. Like the critics, considered earlier, he may be classed as one who closely associated wit with judgment. Unlike

the critics, however, he achieved judgment by means of the devices of fancy--devices which made his judgment palatable.

One of his least-used forms, Fuller's satirical wit is most vociferous in defending his Church-History from the animadversions of Peter Heylin, in making fun of the Roman Catholic Church and its miracles, and in deriding the Irish.

Fuller knew when to restrain his wit, for in The Holy State he indicates that wit should not be used to hurt or bite. In the same work, however, he writes that gravity should not be so strong as to root out mirth.

An examination of Fuller's wit in the pulpit reveals that in his sermons he made use of the same devices of wit as in the other genres, but that he employed them less frequently and more cautiously because of a conscientious desire for decorum.

Microfilm \$2.75; Xerox \$8.60. 187 pages.

THE POETRY OF THOMAS HORNSBY FERRIL

(Order No. Mic 61-2666)

Robert Fulton Richards, Ph.D.
Columbia University, 1961

The dissertation is an attempt to appraise the poetry of Thomas Hornsby Ferril as an apprehension of the Western experience and as a contribution to American Literature.

Oscar Wilde predicted in 1882 that the West would never have a poetry because its mountains are too high: the artist must be the master of his subject. Most Western poetry suggests that the epic history and the dramatic landscape of the Rocky Mountains are incompatible at least with modern literary conventions. Agreeing with Wilde in principle, Ferril has kept mountains under his control with geology. He has been the first poet to write about the natural characteristics of this region without sentimentality. Therefore, the study and the appraisal of his work have a regional significance.

Ferril's personal history is examined to determine the influence of his Western heritage and his industrial occupation upon his poems. His prose is studied to gain insights concerning the poet. His growth as a poet is examined through his four volumes of poetry. The early poems, published in High Passage (1926), have a metaphysical quality of condensation. In his effort to apprehend the West more directly he shifted to a less formal prosody in the longer poems of Westerling (1934). In Trial by Time (1944) the West became only a point of departure as he expanded his apprehension to the subject of time, measured in geological eons. The new work in New and Selected Poems (1952) investigates less profound subjects with humor and whimsy. Ferril attempted deliberately to control the mountains only in Westerling, but the West is present in most of his work to such a degree that it has a regional atmosphere.

Ferril's poems have won many national prizes, have been published by reputable firms and periodicals during the past forty years, and have been praised by a variety of literary commentators from Joel Spingarn to Robert Frost; yet he is virtually unknown. This may in part be the result of his residence in Denver, but is probably due more to his individuality, which has not been properly appraised. He has not been rejected by the critics; he has been ignored. Several of his early poems were too rhetorical to provide

the challenge modern criticism demands. His best work, however, reveals a complex symbolism concerning the positive qualities in the contemporary experience. Since he is analytical, rather than prophetic or disillusioned, his poems appear to lack emotional power; yet in a quiet way he does develop passion because there is a latent emotion in his qualities of love and wonder concerning the human experience. These qualities, rather than uncritical optimism, account for his positive philosophy.

It can be affirmed that Ferril is the first poet to embrace the Western experience with a philosophy that allows him to control his environment. However, he deserves recognition as more than a regional phenomenon.

Microfilm \$4.20; Xerox \$14.65. 325 pages.

**FAITH AND REASON
IN THE THOUGHT OF PIERRE BAYLE
1670-1697**

(Order No. 61-2978)

Karl Christian Sandberg, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Joseph E. Tucker

The possible rational objections to orthodox Christianity which Pierre Bayle set forth in his Dictionnaire historique et critique hastened the transition between the seventeenth and eighteenth centuries and made this work the arsenal of the Encyclopedists. Accordingly, most Bayle critics have, until recently, thought of him as a pre-eighteenth century philosophe. Yet whenever Bayle stated in his Dictionnaire that reason could advance unanswerable objections to the Christian faith, he also maintained that reason itself was an imperfect guide in the area of speculative knowledge and should therefore be subjected to faith when its findings conflicted with the dogmas of revealed religion. The critics who have seen the mature Bayle as an unbeliever have therefore had to assume that he was not sincere in the expression of these views. However, an investigation of Bayle's milieu in Holland with particular reference to the nature of Dutch censorship and civil liberties shows that he could not have had any compelling motive to dissimulate the true nature of his thought, whatever it might have been. In addition, his personal characteristics and acts reveal that his sincerity cannot be impugned. The traditional view of the Rotterdam philosopher must therefore be re-evaluated. The conclusion offered in this dissertation is that Bayle was neither a rationalist, an atheist, nor a sceptic, as the majority of his commentators have variously maintained, but was rather a fideist whose views on faith and reason were moreover the normal outgrowth of his early education.

During his formative years Bayle became imbued with the principles both of Scholastic logic and the new Cartesian rationalism, but at the same time he acquired from his Protestant background the conviction that human nature and reason were corrupt and imperfect. In addition, his experience of being permanently reconverted to Protestantism, after having been momentarily converted to Catholicism (1669-1670), convinced him that the influence of grace, which manifested itself in the conscience, transcended the scope of reason. During the period 1684-1687 his antirational views became more pronounced. In the course of the three-way intellectual struggle which was

then going on between Protestants, Catholics, and heterodox rationalists, Bayle indeed adjudged religious dogmas to be indefensible rationally, but in so doing, however, he also became convinced that purely rational investigation of philosophical and theological questions eventually yielded only antinomies which rendered reason powerless either to affirm or to deny. These conclusions brought him to the threshold of complete doubt, but he avoided the impasse of scepticism by making the dictates of conscience the basis of his religious belief, and he thus remained a loyal member of the Reformed Church.

Even though Bayle had concluded by 1687 that the principles of faith and reason were incompatible, he hesitated to emphasize this disparity, feeling that only the atheists, libertines, and deists could profit thereby. Consequently, after 1687 he turned his attention to purely erudite pursuits and undertook the compilation of a dictionary of historical errors which was later to become the Dictionnaire historique et critique. However, when in 1691 the pastor Jurieu rashly accused Bayle publicly of sedition, conspiracy, and atheism, Bayle's attitude underwent a radical change. Feeling that his honor had been attacked, he lost his restraint and objectivity, and engaged in a campaign to show that Jurieu himself was either a heretic or else was presumptuous to enter into any kind of theological dispute. In the meantime, Bayle had altered the form of his proposed dictionary to include articles on philosophic as well as historical subjects, and in his philosophic articles, Bayle continued his attack on Jurieu by pointing out the rational objections which could be raised to his (Jurieu's) doctrines. It was significantly this personal quarrel, and not a desire to attack religion generally, that moved Bayle to insert in the Dictionnaire the rational criticism of Christian theology which was later to earn him the inaccurate reputation of being an atheist or a sceptic.

Microfilm \$3.25; Xerox \$11.50. 252 pages.

ISRAEL ZANGWILL: A STUDY.

(Order No. Mic 61-2227)

Maurice Wohlgelernter, Ph.D.
Columbia University, 1961

This study is not a "life and works" but rather an attempt to understand Zangwill's "wonderful country" and its "peculiar people," as they appear in his books. More specifically, this study attempts to show Zangwill's thought in all its complexity and to relate it to the historical and intellectual events of the late nineteenth and early twentieth centuries, placing it specifically in the stream of English literature. Because this study treats Zangwill's ideas in their development, it may be thought of as a sort of biography of Zangwill's mind.

This study is divided into five parts. The first is devoted mainly to those biographical facts which, taken together, clearly indicate the shaping of his spirit. This spirit was both attracted to and repelled by his early surroundings, forcing him constantly to choose between being an Englishman and a Jew. Early in his career he decided to choose the role of the "rebel," remaining to the end the "conscientious gadfly" of mankind. Because so much of what Zangwill wrote is unknown to the common reader, Chapter Four surveys briefly the two main categories into which his work falls.

In Part Two, Children of the Ghetto, his most famous novel, is placed in its literary setting among the other realistic novels of the nineties, with special emphasis on those differences which distinguish Zangwill from his contemporaries. In relation to this, Zangwill's understanding of comedy and humor, which, he believed, are closely allied to tragedy and his attempt to understand some significant dreamers of the ghetto who failed in their attempt to reconcile Hebraism and Hellenism are reviewed.

Part Three is devoted entirely to Zangwill's quasi-political activities, first with the Zionist movement and then with the Jewish Territorialist Organization, whose presidency he assumed after the Sixth Zionist Congress. Here are examined the main currents of Zionist thought in the nineteenth century and their role in Zangwill's works, the fateful meeting with Herzl and Zangwill's attachment to him, the break with Zionism and Zangwill's decision to organize an international agency to secure a haven of refuge for his suffering people anywhere, and Zangwill's conviction that America is and must remain a giant melting pot where all the different races of mankind would be melted into a new race.

Part Four deals with Zangwill's aesthetic. Zangwill was torn between admiration for Tolstoy's conception of art with a purpose and for the French symbolists. His sympathies were, of course, with the former; witness his novel The Master about art and artists. A discussion dealing with more of the non-ghetto works, like The Mantle of Elijah, develops Zangwill's thesis that the artist, like all idealists, must never limit his interest to the mere "love of beauty" only but must also justify this love as a constituent and influential part of life. Related to this conviction were Zangwill's peace efforts during the first World War and his hopes that his dramatic works would serve as a dyke to hold back the "tenacious beating of the waves of barbarism."

Part Five, consisting of one chapter, is a kind of spiritual biography. Though Zangwill greatly admired the orthodox faith in which he was reared, he had decided at the beginning of his literary career that it had to be changed to incorporate some of the essentials of Christianity. The problem, then, was one of tradition versus change. That Zangwill chose the latter while simultaneously admiring the former is not surprising. In everything he faced, Zangwill always showed "the reverse of the medal." How Zangwill attempted to solve this conflict is the subject of this final chapter. Microfilm \$5.30; Xerox \$18.90. 416 pages.

THE ARGENTINE DETECTIVE STORY

(Order No. Mic 61-2809)

Donald Alfred Yates, Ph.D.
University of Michigan, 1961

This study undertakes to examine the development of the detective story in Argentina as a fictional genre. The fact that the género policial has been popular in Argentina for over half a century and, within the past twenty years, has been cultivated by a large number of Argentine writers--among them some of the country's foremost literary figures--suggests that it is a contemporary literary form worthy of examination.

Part I of this work documents the history of the Argent-

tine detective story, while Part II is devoted to the critical examination of a number of representative examples of Argentine detective fiction on the basis of what may be called "the international standards" of detective fiction.

Part I indicates the following: the "antecedents" of the modern Argentine detective story go back as far as 1845 to Facundo; the first formal Argentine detective novel appeared in 1940; shortly thereafter, a group of highly-regarded Argentine authors (Borges, Bioy, S. Ocampo, Peyrou, Castellani, et. al.) undertook the cultivation of the género policial; by 1948 virtually all of these authors had ceased writing detective fiction and a new group of "popular" writers had appeared which dominated the genre until 1954 when the number of locally-written detective stories sharply declined; and finally, in post-1954 fiction the detective story elements could be observed merging with other non-detective novelistic features, thus producing what could be termed "humanized" detective fiction. A final chapter indicates that the attitude toward the género policial demonstrated by Argentine literary critics has always been favorable, but that most criticism has been concerned with the essentially intellectual features of the genre.

In Part II, following a consideration of what may be regarded as the "international standards" of detective fiction, a critical analysis is given of fifteen representative examples of Argentine detective fiction. These examinations show that the "early literary" authors wrote detective fiction which was characterized by a tone of satire or parody--of external elements such as stereotyped human figures (as in the Parodi stories by Borges and Bioy) or of the detective story itself (as in Los Que aman, odian by Bioy and Silvina Ocampo). The detective story has even lent itself as a form for expressing philosophical and metaphysical ideas (Borges). The "popular" writers, on the other hand, while frequently showing ingenuity in plotting, generally handled the detective story elements in a conventional manner. Finally, in the "detective novels" published during the period 1955 to 1959 (the terminal date of this study) it is observed that certain authors were abandoning the traditional forms of the detective genre in favor of the more modern, "humanized" type of detective fiction which holds the characters to be at least as important as the puzzle or mystery element involved.

The basic conclusions are the following: 1) The Argentine detective story is seen partly as a by-product of, partly as a reaction to the abundance of detective fiction translations (from French and English) of the Twenties and Thirties. 2) During a brief span of half-a-dozen years, a number of authors associated with the Argentine intellectual élite cultivated the género policial in either of two fashions: in a mood of parody or satire which made light of the genre, or in a mood of seriousness, using the classical, intellectual structure of the detective story as a vehicle for philosophical and even metaphysical considerations. 3) Appearing mainly between 1948 and 1954, the "popular" writers characteristically wrote standard mysteries for that large popular audience which was well accustomed to the traditional devices of this type of fiction. 4) After 1954, the local cultivation of the detective story declined sharply, and the traditional features of the detective story appeared to be merging with those of the "straight" novel, "la novela de siempre," from which this specialized genre had originally descended.

Microfilm \$3.70; Xerox \$13.05. 288 pages.

MATHEMATICS

A MATHEMATICAL THEORY OF GUARANTEE POLICIES

(Order No. Mic 61-1014)

Lloyd Franklin Bell, Ph.D.
Stanford University, 1961

This study considers the mathematical theory of guarantee policies for items which fail under use or deteriorate with time, and for which the length of the guarantee is significantly related to the anticipated life of the item.

The purpose of the study is to ascertain the factors which determine the guarantee policy under which a producer can earn the maximum profit for the sale of a commodity or service. Criteria for the selection of such a guarantee policy depend on the following quantities: the production cost of the commodity sold, its sale price, the probability distribution of its time of failure, the demand or sales volume, and the effect of the guarantee policy on demand.

The major results of the policy are obtained by analyzing a family of guarantee policies which may be described as follows: if an item that is guaranteed for a period of time of length x fails at time $\xi < x$ after the beginning of the period, the item is replaced and the guarantee is renewed with the customer being charged the fraction $k\xi/x$, $0 \leq k \leq 1$, of the price of the item. The extreme cases, where $k = 0$ and $k = 1$, correspond to guarantee policies in common use.

The long-term average rate of profit per customer, $R_1(k,x)$, is obtained by the use of known results in renewal theory. If the distribution of the time of failure, $F(\xi)$, has mean unity, the sales price is unity, and C_o is the production cost, then

$$R_1(k,x) = 1 - C_o + \frac{k}{x} \int_0^x u dF(u) - F(x).$$

The demand function, $D(k,x)$, is assumed to be a continuous, non-negative, non-decreasing function of x and a continuous, non-increasing function of k . The major results involve demand functions restricted to the form

$$D(k,x) = \varphi[g(k) \cdot x],$$

where $\varphi(\cdot)$ is a continuous, non-negative, non-decreasing function and $g(\cdot)$ is a continuous, non-negative, non-increasing function. The long-term average rate of overall profit is

$$R(k,x) = R_1(k,x) \cdot D(k,x).$$

The criteria for selecting an optimal guarantee policy are derived by finding the particular values of k and x which maximize $R(k,x)$. In general, $R(k,x)$ may have more than one local maximum; therefore, both the necessary conditions for a local maximum to exist and additional conditions which are sufficient for it to be unique are considered. Criteria are obtained for existence and uniqueness of local maxima for the following cases of parameter

values: $x = 0$ (no guarantee is given), $k = 0$ (replacement without charge), $k = 1$ (replacement charge is the full sales price prorated over the length of the guarantee), and the general case $0 < k < 1$.

A step by step procedure, by which the criteria for selecting an optimal policy can be applied to a guarantee problem, is given. This procedure is applied to an example based on the negative exponential failure distribution. In the example, various particular demand functions are used to illustrate conditions under which the guarantee parameter values above are optimal.

An alternative formulation of the generalized guarantee model is also considered. The alternative differs from the initial model in the following manner: when a failed item is replaced under the guarantee, the guarantee is extended by an amount $k\xi$ only, rather than being renewed. This formulation includes the same $k = 1$ policy as the first model. Under the $k = 0$ policy of the alternative, the guarantee is not extended beyond the original expiration time. A complete analysis of the alternative model is not made, but criteria for the direct comparison of the $k = 0$ and $k = 1$ policies are obtained.

Microfilm \$2.75; Xerox \$3.00. 60 pages.

ON THE CONVERGENCE OF SOLUTIONS OF CAUCHY PROBLEMS FOR ELLIPTIC DIFFERENCE EQUATIONS

(Order No. Mic 61-2614)

Jerome B. Freier, Ph.D.
New York University, 1958

Adviser: Fritz John

When the derivatives in a partial differential equation are replaced by differences, a difference equation is obtained. In the case of a Cauchy problem for a given differential equation, the Cauchy data must also be replaced by differences in order to obtain the counterpart of the Cauchy problem in difference form. As the increments of the variables tend to zero, this difference problem reduces to the original differential problem. It remains, however, to consider whether the solution of the difference problem converges to the solution of the differential problem.

In this paper this question is considered in connection with Cauchy problems for linear elliptic differential equations with constant coefficients and for the three-dimensional wave equation with data on a time-like plane. These problems are all "improperly set" in the sense of Hadamard. In spite of this, it is shown that the solution of the difference problem converges to the solution of the differential problem provided the Cauchy data are analytic. For non-analytic data, for the two-dimensional potential equation and for the wave equation with data on a time-like

plane, in each case an example is constructed where the solution of the difference problem does not converge to the solution of the differential problem.

In addition to the general n^{th} order linear elliptic equation in m variables with constant coefficients, the following special elliptic equations are treated: the two and three-dimensional potential equations, $\Delta u + u = 0$ and the bi-harmonic equation. The three-dimensional wave equation with data on a time-like plane is also treated. In the case of the two-dimensional potential equation, estimates are made of the "truncation error" and of the "data error."

The method employed is briefly as follows: First, a solution of the difference equation of exponential type is assumed. Substituting this into the difference equation yields the so called auxiliary difference equation which plays a central role in the method. The auxiliary equation is solved for one of the parameters in the assumed solution of the difference equation which can then be expressed in terms of the remaining parameters. By superposition (i.e. addition and integration), the solution of the difference equation satisfying the Cauchy data can now be obtained. To do this, the original difference problem is replaced by n special Cauchy problems each consisting of the original difference equation and having initial data all zero except one. This datum corresponds to one of the data in the original difference problem. The sum of the solutions of the special problems then yields the solution of the original problem. The solution of each special Cauchy problem is in the form of a Fourier integral. The existence of these Fourier integrals is demonstrated by means of estimates obtained from the auxiliary equation. The convergence of the solution of the difference problem to the solution of the differential problem is then completed by using estimates also obtained from the auxiliary equation.

Microfilm \$2.75; Xerox \$3.60. 61 pages.

CENTRAL LIMIT THEOREMS
AND ASYMPTOTIC EFFICIENCY FOR
ONE SAMPLE NON-PARAMETRIC PROCEDURES

(Order No. Mic 61-2143)

Zakkula Govindarajulu, Ph.D.
University of Minnesota, 1961

Let X_1, X_2, \dots, X_m and Y_1, Y_2, \dots, Y_n be ordered observations from absolutely continuous cumulative distribution functions $F(x)$ and $G(x)$ respectively. Define $Z_{N,i} = 1$ if the i^{th} smallest of $N = m+n$ observations is an X and $Z_{N,i} = 0$ otherwise. Define a class of test statistics by

$$\tau_N = mT_N = \sum_{i=1}^N E_{N,i} Z_{N,i} \text{ where } E_{N,i} \text{ are given numbers.}$$

Many non-parametric statistics are of the form τ_N or T_N . With a slight modification this formal arrangement for two sample problems becomes useful for one sample problems. Thus in the one sample problem the X 's can represent the values of the positive observations and the Y 's the negative of the values of the negative observations. (Because of the absolute continuity assumption, there will be no zeros. Generally, other values than zero could have

been used as the breaking point.) In this model the one sample problem has been changed to a two sample problem — the sample of positive values and the sample of negative values. The novelty of the situation arises from having the sample sizes as random variables. In particular, the sample size for the X 's has a binomial distribution with parameters N and the probability that one of the original observations was positive. Finally, the F and G functions become respectively the conditional distributions of the positive observations and the negatives of the negative observations. For the Wilcoxon one sample test, $E_{N,i} = \frac{i}{N}$ and for Fraser's test (see *Annals of Mathematical Statistics*, Volume 28, 1957, pages 1040-43.) $E_{N,i}$ is the expected value of the i^{th} smallest order statistic in a random sample of size N drawn from a chi-population with one degree of freedom.

Carrying out tests or computation of power necessitates a knowledge of the distributions of τ_N . Exact distributions will be quite complicated except for small values of N . In many cases, however, as N increases, the distribution of τ_N when suitably standardized, approaches the normal distribution. Contributions by Wald and Wolfowitz, Noether, Hoeffding, Lehmann, Madow, Dwass, and Chernoff and Savage have appeared in the literature giving sufficient conditions for the asymptotic normality (asn) of T_N for the two sample problem. The results of Chernoff and Savage (see *Annals of Mathematical Statistics*, Volume 29, 1958, pages 972-994.) cover more situations with $F \neq G$, especially the C_1 -test procedure not covered by Dwass' general theorem. (see *Annals of Mathematical Statistics*, Volume 27, 1956, pages 352-372.) Konijn has given a theorem to handle test statistics arising from one sample procedures (see *Journal of Indian Society of Agricultural Statistics*, Volume 9, Number 2, 1957, pages 145-167.) which is difficult to apply to Fraser's statistic under the alternative hypothesis, namely $F \neq G$. Thus, the available large sample theory is inadequate.

In this thesis sufficient conditions for the asymptotic normality of τ_N with $F = G$ or $F \neq G$ are given, when m and n are random but N is non-random. The main results on asn of τ_N constitute generalizations of the results of Chernoff and Savage. An important application of the main results is made to Fraser's statistic used to obtain a locally most powerful rank test for location with symmetry, against normal alternatives. Using the main results, the distribution of the test statistic is shown to approach the normal distribution for large N , under all hypotheses. By a variational argument, it is established that Fraser's test for a translation parameter has asymptotic efficiency with respect to the t-test greater than or equal to unity for any distribution of the observations in the sample (equality holds if and only if the population sampled is normal.).

Microfilm \$2.75; Xerox \$4.00. 72 pages.

**A TEST OF LINEARITY VERSUS CONVEXITY
OF A MEDIAN REGRESSION CURVE**

(Order No. Mic 61-1021)

Bruce Marvin Hill, Ph.D.
Stanford University, 1961

A test is proposed of the null hypothesis of linearity of a median regression curve against the alternative hypothesis of convexity. To be specific, we test

$$H_0: Y_i = \alpha + \beta X_i + \epsilon_i, \quad i = 0, 1, \dots, n,$$

against

$$H_1: Y_i = \phi(X_i) + \epsilon_i, \quad i = 0, 1, \dots, n$$

where α , β and ϕ are unspecified, and $\phi(x)$ is a convex function. The basic assumption underlying the test is that the ϵ_i are independent identically distributed random variables with median zero and with a continuous density function $f(\epsilon)$ such that $f(0) > 0$. The X_i are fixed.

The test consists in estimating a line by the Mood-Brown procedure (using medians) from a central subset of the observations, making a weighted count of the number of remaining observations above the line, and rejecting H_0 when this number, R_n , is large. The test can easily be adapted to a one sided alternative of concavity or to a two sided alternative of either convexity or concavity.

The test statistic, R_n , is shown to have an asymptotically normal distribution, the asymptotic power of the test is obtained, and the test is shown to be consistent against all twice differentiable strictly convex alternatives. The asymptotic distribution of the Mood-Brown line estimator is also obtained.

For a sequence of parabolic alternatives converging to a straight line the relative asymptotic efficiency of the test as compared to the least squares test is found in the case where errors are normally distributed. Finally, results of Monte Carlo experiments, used to investigate the small sample behavior of R_n under the null hypothesis, are presented.

Microfilm \$2.75; Xerox \$3.80. 68 pages.

**WATER WAVES PRODUCED BY
SURFACE DISTURBANCES**

(Order No. Mic 61-2638)

Herbert C. Kranzer, Ph.D.
New York University, 1957

Adviser: Richard Courant

The principal goal of this paper is the presentation of a computationally feasible method for solving arbitrary initial value problems for the equations of the "linearized exact" theory of water-wave propagation in water of constant finite depth. Both two-dimensional and three-dimensional wave motions are considered, and in both cases the only physical assumption made is that the initial conditions (and therefore the solution) possess symmetry about a fixed vertical line. The results obtained are thus directly applicable to the computation of the heights of waves appearing in channels, rivers, lakes or oceans at moderate

or large distances from an essentially local disturbance such as an explosion.

These results are of two kinds. The first class of results permits the determination of the entire motion once the precise form of the initial disturbance is known. The second type provides upper bounds on the amplitude of possible wave motions which depend only on the general size, but not on the detailed shape, of this disturbance.

The solutions found are compared with the corresponding solutions of the "shallow water" theory, leading to a somewhat surprising restriction on the range of validity of the latter. In addition, various experimental results which are in apparent accord with the formulas found in the paper are summarized.

Microfilm \$2.75; Xerox \$3.80. 66 pages.

**ENTIRE FUNCTIONS AS LIMITS
OF ZERO-RESTRICTED POLYNOMIALS**

(Order No. 61-2963)

John Edward Lange, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Jacob Korevaar

Let R be an unbounded closed set in the complex plane, $D(R)$ the set of all points $e^{i\theta}$, where θ runs through the asymptotic directions of R . The problem is to characterize the class $C(R)$ of all the entire functions $\neq 0$ which can be obtained as the limit, uniformly in every bounded domain, of a sequence of R -polynomials (An R -polynomial is a polynomial whose zeros belong to R). Several years ago, Korevaar obtained characterizations in the following two cases: (i) if $D^j(R)$ never belongs to an arc π , $j = 1, 2, \dots$; (ii) if $D^j(R)$ does not belong to an arc π when $1 \leq j < k$, and $D^k(R)$ belongs to an arc $< \pi$. Question: what can one say if $D^k(R)$ does not belong to an arc $< \pi$, but spans an arc π ?

This thesis contains a characterization of $C(R)$ for arbitrary (closed) radial sets, that is, sets with the property that if $z \in R$ then $\lambda z \in R$ for all $\lambda \geq 0$. For a radial set R not satisfying condition (i) above, we show first that the order of the set R (that is, the l.u.b. of the orders of the functions in $C(R)$) is an integer N , and attained by a zero free function (It is known if condition (i) is satisfied that $C(R)$ consists of all the entire functions $\neq 0$ whose zeros belong to R).

For a radial set R of finite order N , there exist non-empty closed convex radial sets $S_j = S_j(R)$ such that

$$\exp(a_1 z + a_2 z^2 + \dots + a_N z^N) \in C(R)$$

if and only if $a_j \in S_j$, $j = 1, 2, \dots, N$. The sets S_j , $j < N$, are either the plane, a half-plane having the origin on its boundary, or a line containing the origin; S_N is always an angle $< \pi$ (including just a ray).

It is now possible to characterize $C(R)$ for arbitrary radial sets and we may suppose condition (i) above is not satisfied. Then with N as above $C(R)$ is the class of the entire functions of the form

$$az^m \exp\{a_1 z + \dots + a_N z^N\} \prod_p (1 - z/z_p) \exp\{z/z_p + \dots + z^{N-1}/(N-1)z_p^{N-1}\}$$

where m is an integer ≥ 0 , $0 \neq z_p \in R$, $\sum_p |z_p|^{-N}$ is convergent, a_j is arbitrary if S_j is the plane, $a_N \in S_N$, and where

$$a_j + (1/j) \sum_p z_p^{-j} \in S_j$$

for all other j in the sense that the distance between

$$a_j + (1/j) \sum_{|z_p| < r} z_p^{-j} \text{ and } S_j$$

tends to 0 as $r \rightarrow \infty$.

The results are also valid for sets which resemble radial sets. Microfilm \$2.75; Xerox \$3.00. 50 pages.

bounded 3rd derivatives in the closed domain, that as the mesh width $h \rightarrow 0$ the scheme converges to the desired solution.

The solution of the problem is analytic in the interior of the region, but may not have bounded 1st partial derivatives at certain boundary points. In order to include a larger class of boundary value problems, it is shown that the solution of the finite difference equations will approximate the solution of the differential equation to any desired degree of accuracy in a compact subdomain of the original domain. In the Appendix is described an attempt to solve the boundary value problem where on part of the boundary σ , instead of prescribing the function, an oblique derivative is given. Most of the arguments go through in this case, but the existence of a special function needed to prove the basic inequality could not be shown.

Microfilm \$2.75; Xerox \$3.00. 48 pages.

A NUMERICAL SCHEME FOR SOLVING A BOUNDARY VALUE PROBLEM FOR THE TRICOMI EQUATION

(Order No. Mic 61-2609)

Dorothy E. Levy, Ph.D.
New York University, 1958

Adviser: Lipman Bers

The Tricomi equation $y u_{xx} + u_{yy} = 0$ is a 2nd order partial differential equation of mixed type. It is elliptic in the upper half plane, hyperbolic in the lower half plane, and degenerate parabolic on the x -axis. A scheme for solving this equation numerically is given and proved convergent.

Consider the domain bounded by a curve σ lying in $y \geq 0$ with only its end points A and B on the x -axis and by two characteristic segments Γ_A and Γ_B , which pass through A and B respectively and intersect in C . The boundary value problem which is studied is the one of finding a solution $u(x,y)$ of the Tricomi equation, in the region bounded by σ and the line segment AB , which vanishes on Γ_A and takes on continuous boundary values on σ . Use is made of an integro-differential equation which comes from an expression derived by Tricomi,

$$u_y(x,0) = \frac{\sqrt{3}}{2\pi k} \int_0^x \frac{u_\lambda(\lambda,0)}{(x-\lambda)^{2/3}} d\lambda \text{ where } k > 0. \text{ The Tricomi}$$

equation and the integro-differential equation are replaced by finite difference equations (where a sum replaces the integral) in $\sigma + AB$. The set of equations, for a fixed mesh width h is shown to satisfy a maximum-minimum principle which implies the unique existence of the solution of the difference equations.

It is then shown, again for a fixed mesh width h , that these difference equations can be solved by a Liebmann iteration scheme. It still remains to prove that the solutions of these equations converge to the solution of the differential equation as $h \rightarrow 0$. This is accomplished by first proving an inequality similar to one derived by L. Bers for elliptic equations. The proof of the inequality depends on having a maximum-minimum principle. An estimate is made to obtain the maximum difference of the difference equations from the differential equation and the integro-differential equation. Using this estimate and the inequality it is easily shown, assuming that the solution has

ON THE EXTERIOR PROBLEM FOR THE ELASTIC BODY EQUATION

$$\mu \Delta U + (\mu + \lambda) \nabla (\nabla \cdot U) + \omega^2 \rho U = 0$$

(Order No. Mic 61-2588)

Martin M. Lipschutz, Ph.D.
New York University, 1958

Adviser: Fritz John

The paper proves that a solution to the reduced elastic body equation $\mu \Delta U + (\mu + \lambda) \nabla (\nabla \cdot U) + \omega^2 \rho U = 0$ in the exterior domain is uniquely determined by the radiation conditions

$$\lim_{v \rightarrow \infty} \int_{C_V} |\nabla_A U - ik_1 \xi_A U|^2 dr = 0, \quad k_1^2 = \frac{\omega^2 \rho}{\mu}, \quad k_2^2 = \frac{\omega^2 \rho}{2\mu + \lambda}.$$

and prescribed boundary values for either the displacements U or for the stress vector $T(U)$. An integral representation in terms of the fundamental solution is obtained for exterior solutions, and a general solution W is shown to be uniquely expressed as a sum, $W = U + V$, of a solution U satisfying the radiation conditions and a solution V which is everywhere regular. An asymptotic representation for solutions U satisfying the radiation conditions is obtained in terms of simple progressive

waves of the form $\frac{e^{ikv}}{v}$. It is also shown that solutions

in the exterior which satisfy the weak radiation conditions above must necessarily satisfy the strong conditions

$$\lim_{v \rightarrow \infty} v(\nabla_A U - ik_1 \xi_A U) = \lim_{v \rightarrow \infty} v(\nabla \cdot U - ik_2 \xi \cdot U) = 0, \text{ uniformly in } \xi.$$

Microfilm \$2.75; Xerox \$3.00. 39 pages.

**PROBLEMS IN
STABLE POPULATION THEORY**

(Order No. Mic 61-1996)

Alvaro Lopez, Ph.D.
Princeton University, 1960

A female human population is considered in Demography as a self-renewing aggregate submitted to a specified regime of age specific probabilities of survival and childbearing. When migration is absent and such a regime is kept constant through time, the demographic behaviour of the population has well known properties which were first pointed out by Alfred J. Lotka.

At the bottom of Lotka's formulation of this model there is the problem of having an explicit formula for the number of births accruing to the relevant population at any moment in time. Lotka solved this problem along a previously known method which has some similarities to a standard Fourier decomposition although the waves are in general not harmonic.

Lotka's solution was for some time the subject of a rather heated controversy. One of the aims of this thesis has been to clarify the issue in the light of easily recognizable demographic considerations.

Although conceptually simple, a rigorous exposition of Lotka's model along his classical treatment cannot evade intricate and tedious mathematical manipulations, which disappear when the model is present in a discrete framework rather than in a continuous one, as a standard application of the probabilistic theory of recurrent events makes apparent.

This discrete formulation makes possible a generalization of the long run behaviour of the age structure of a closed population when fertility and mortality rates are allowed to change with the passage of time. This proposition, which has some close similarities with the weak ergodic properties of a non homogeneous Markov Chain, asserts that the age structure of a population is asymptotically independent of the shape it took in the far distant past, the transient effects of which are washed out by the intervening history of fertility and mortality. A proof of this theorem is included, but as usual in Renewal Theory, no insights on the speed of the process are disclosed by this formal treatment.

An immediate corollary of this weak ergodic result is the well known asymptotic stability and the algebraic properties of the age structure under Lotka's conditions of unchanging vital rates. The reformulation of the classic model under this alternative approach is substantially simplified, with an advantage for the non mathematician since the weak ergodic process can be intuitively grasped, as shown in the dissertation.

After restating the significance of stable population theory for demographic analysis, an application is made to the problem of estimating the vital rates and the age structure in Colombia, for the last available intercensal period.

Microfilm \$2.75; Xerox \$5.80. 118 pages.

**GENERALIZED FUNCTIONS AND
THE FUNDAMENTAL SOLUTIONS FOR
POLYHARMONIC DIFFERENCE OPERATORS**

(Order No. Mic 61-2430)

Bernard Lubarsky, Ph.D.
Case Institute of Technology, 1961

The work of Lighthill on Fourier transforms and Fourier series of generalized functions and on asymptotic estimates of Fourier transforms and Fourier coefficients is extended to more than one dimension.

Using these results, representations for the fundamental solutions of polyharmonic differential and difference operators, Δ^M and D^M , in n -dimensional space are derived in terms of Fourier transforms and Fourier coefficients of generalized functions. A method of computing the asymptotic expansion of the fundamental solution for the discrete polyharmonic operator, D^M , in n -dimensional space is derived and the first two terms of the expansion are evaluated for all M and all n .

The discrete potential method developed by Saltzer which utilizes the fundamental solution in the solution of inhomogeneous harmonic difference equations is extended to the inhomogeneous biharmonic difference equation.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

**TESTING EQUALITY OF MEANS
UNDER VARIANCE HETEROGENEITY**

(Order No. Mic 61-2263)

Roger Stewart McCullough, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Dr. John Gurland

Two independent Normal populations $N(\mu_1, \sigma_1^2)$ and $N(\mu_2, \sigma_2^2)$ are given, and samples of sizes n_1 and n_2 respectively are drawn from them. The problem considered is that of testing the hypothesis $H_0: \mu_1 = \mu_2$, without assuming $\sigma_1^2 = \sigma_2^2$. Define the sample means, \bar{x}_1 and \bar{x}_2 , and the sample sums of squares of deviation about the mean, Σ_1 and Σ_2 . Let $f_1 = n_1 - 1$, $f_2 = n_2 - 1$, and $R = \sigma_1^2/\sigma_2^2$. It is desired to find a statistic for testing H_0 which has size (probability of rejecting H_0 when true) as constant as possible, and power (probability of rejecting H_0 when false) as high as possible, over a suitable range of the parameter R . Two cases are considered - the unilateral case, in which it is assumed that $1 \leq R \leq \infty$, and the bilateral case in which no assumptions are made about R .

Three different approaches to this problem are developed. In the first approach, a general statistic Y of the form $(\bar{x}_1 - \bar{x}_2)^2/(r_1 \Sigma_1 + r_2 \Sigma_2)$ is considered. Y has the distribution of $\chi_1^2/(\lambda_1 \chi_{f_1}^2 + \lambda_2 \chi_{f_2}^2)$ where λ_1 and λ_2 are specified functions of r_1 , r_2 , n_1 , n_2 and R , and r_1 and r_2 are constants. The conditions used to fix r_1 and r_2 are to set the size equal to a constant α at $R = 1, \infty$ for the unilateral case, and at $R = 0, \infty$ for the bilateral case. These conditions keep the size $\leq \alpha$ over the relevant range of R , and for the unilateral case the size is almost a constant value. Tables are presented giving the optimal

statistics for n_1 and n_2 equal to 3, 5, 7, 9 and also giving size and power. The power is compared to that of the corresponding t-test when R is known, and is found to compare reasonably well.

According to the second approach, the hypothesis H_0 is rejected when the confidence intervals for the individual means do not overlap. This leads to a statistic of the form $W = (\bar{x}_1 - \bar{x}_2) / (r_1 \sqrt{\Sigma_1} + r_2 \sqrt{\Sigma_2})$. This statistic has the distribution $N(0,1) / (\lambda_1 X f_1 + \lambda_2 X f_2)$, but in order to compute the required critical points and size, an approximation to the denominator of the form $m \chi_n$ was used, where m and n are obtained of equating appropriate moments. Optimal statistics are derived using the same conditions on size as in the first approach. Tables of the optimal statistics and size values are presented for $(n_1, n_2) = (3,3), (3,5), (3,7), (5,3), (5,5), (7,3)$ at several R values.

In the third approach, a preliminary test is first performed of the hypothesis $H'_0 : \sigma_1 = \sigma_2$, using the statistic Σ_1 / Σ_2 . If H'_0 is accepted then the statistic

$$u^2 = (\bar{x}_1 - \bar{x}_2)^2 / \left(\frac{1}{n_1} + \frac{1}{n_2} \right) \frac{\Sigma_1 / R + \Sigma_2}{n_1 + n_2 - 2}$$

is used to test H_0 , and if H'_0 is rejected then ku^2 is used to test H_0 . Given n_1 and n_2 , the constant k and the critical points of the tests of H'_0 and H_0 are determined by setting the size of the test of H_0 equal to a constant α at $R = 1$ and in the unilateral case, and at $R = 0, 1$ and ∞ in the bilateral case. Tables of the corresponding constants for $(n_1, n_2) = (3,3), (3,5), (3,7), (5,3), (5,5), (7,3)$ are presented, as well as tables of size and power, and comparisons are made with the other approaches.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

LINEAR AND NONLINEAR DIFFERENTIAL POLYNOMIALS

(Order No. Mic 61-1082)

David Godfrey Mead, Ph.D.
Columbia University, 1959

Let \mathcal{U} be a universal extension of the rational numbers with field of constants \mathcal{K} , and let y be a differential indeterminate over \mathcal{U} . An ordinary differential polynomial F of order n in $\mathcal{U}\{y\}$ is called sublinear if there exists a linear L and a polynomial B of order $< n$ such that every solution of $F = 0$ is a solution of $B \cdot L = 0$.

Utilizing certain gradings of $\mathcal{U}\{y\}$, called F -gradings, where the nonlinear F is of the form $Iy^{(n)} + Q$, $I, Q \in \mathcal{U}\{y\}$, $IQ \neq 0$, $\deg Q > 0$ and $\text{ord } IQ < n$, it is shown that if F is sublinear, then so are certain polynomials $G \in \mathcal{K}\{y\}$ related to F in a certain way by means of an F -grading. With this it is shown that F is not sublinear if $\deg I = 0$, and for certain cases when $\deg I \neq 0$. The main theorem states that for any nonlinear F there exists an integer k such that the i^{th} derivative of F is not sublinear for $i \geq k$. It is also shown that for "most" F , $k = 2$.

Microfilm \$2.75; Xerox \$3.00. 26 pages.

The items following each abstract are: the price of a microfilm copy; the price of a copy enlarged by the Xerox process to $6 \times 8\frac{1}{2}$ inches; the number of pages in the manuscript. Please order copies by number.

GAMES ON THE UNIT-SQUARE WITH DISCRETE PAYOFF

(Order No. Mic 61-1032)

Marcel Fernand Neuts, Ph.D.
Stanford University, 1961

The value and pairs of optimal strategies are obtained for games over the unit-square, whose payoff is defined as follows:

$$\begin{aligned} K(\xi, \eta) &= a & \eta > \varphi(\xi) \\ &= b & \varphi(\xi) \geq \eta \geq \xi \\ &= 0 & \eta < \xi \end{aligned}$$

where $b > \max(a, 0)$ and $\varphi(\xi)$ is a strictly increasing continuous function of ξ , satisfying the condition that: $1 \geq \varphi(\xi) > \xi$ and $\varphi(\xi_0) = 1$ for some $\xi_0 < 1$.

The set of optimal strategies is infinite in general and contains a subset of optimal mixed strategies which concentrate at a specific finite number of points, determined by the function $\varphi(\xi)$.

Admissible minimax strategies are shown to exist and a class of admissible strategies of finite type is exhibited.

The definition of the payoff $K(\xi, \eta)$ on the lines $\xi = \eta$ and $\varphi(\xi) = \eta$ can also be relaxed considerably, without affecting the value and at least some pairs of optimal strategies of the original game.

A general method is further indicated to obtain the value and optimal strategies for games with a payoff defined as follows:

$$\begin{aligned} K(\xi, \eta) &= a & \eta > \xi + \mu \\ &= b & \xi + \mu \geq \eta > \xi + \nu \\ &= c & \xi + \nu \geq \eta \geq \xi \\ &= 0 & \eta < \xi \end{aligned}$$

where $a < b < c$ and $c > 0$.

Details of the computational results are given in two special cases.

Finally the relationship of these classes of games to a family of matrix-games is pointed out and discussed in some detail. Microfilm \$2.75; Xerox \$3.00. 52 pages.

THEORY OF MINIMUM VARIANCE ESTIMATION WITH APPLICATIONS

(Order No. Mic 61-2265)

Jose Nieto de Pascual, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Herman O. Hartley

This study was concerned with the theory of minimum variance estimation. The techniques of the classical Calculus of Variations were applied to find the solution to the following problem:

Consider Ω to be a proper non-empty subclass of the class L^2 of quadratic summable functions in the Lebesgue sense, such that the elements $t(x)$ of Ω are bounded estimators, based in a random sample of x_1, \dots, x_n , of the

parameter θ of a population with density function $\phi(x_i; \theta)$. The class Ω consists of all bounded estimators of θ with the same expectation function $\mu(\theta)$. It is required to find the estimator $t^*(x)$ of θ , among the elements of Ω , such that the Mean Square Error (MSE) of $t(x) \in \Omega$ would be minimum for $t(x) = t^*(x)$. This problem may be regarded as an isoperimetric problem in the Calculus of Variations; it contains the minimization of the variance of $t(x)$ as the special case when $\mu(\theta) = \theta$. The problem requires a careful specification since various possibilities arise. We may require to minimize the MSE of $t(x)$ for

- 1) one particular value of θ , say θ_0
- 2) a 'dense' or finite set of values of θ
- 3) all values of θ in the parameter space.

For each of these cases, several isoperimetric side conditions may be specified. The competitor functions $t(x) \in \Omega$ may have a prescribed expectation given by

- a) $\mu(\theta) = \mu(\theta_0)$, for $\theta = \theta_0$
- b) $\mu(\theta) = \mu(\theta_i)$, for a 'dense' or finite set of θ values
- c) $\mu(\theta)$ for all values of θ in the parameter space.

Thus, nine possibilities are envisaged, each one consisting of the combination of one of the cases of MSE minimum with one of the isoperimetric conditions. The solution to problems (a, 1), (a, 2), (a, 3) and (b, 3), obtained by Calculus of Variations, depends on the parameter θ . Since the optimal estimator $t^*(x)$ must be independent of θ in order to be of use as a statistical estimator, the remaining five problems are considered only. Problems (b, 1), (c, 1) and (c, 2) admit solutions that are independent of θ in special cases only. The Euler equation for problem (b, 2) was found to be a necessary and sufficient condition for $t^*(x)$ to be the solution, which was shown to be unique almost everywhere. In the limit, the Euler equation $\lambda_0(\theta)t^*(x)\phi(x; \theta) = 0\zeta(\theta)\phi(x; \zeta)$ was shown to be a necessary and sufficient condition for $t^*(x)$ to be the solution of problem (c, 3). The symbol $0\zeta(\theta)$ represents a general linear operator onto $\phi(x; \zeta)$, and ζ is a variable whose domain is the θ space.

Several special forms of $0\zeta(\theta)$ are discussed; the linear differential operator reproduces the known theory of minimum variance estimation and its connection to sufficient statistics. The integral equation form of $0\zeta(\theta)$ shows that previous results in the literature, on necessary conditions for $t^*(x)$ to be minimum variance unbiased, are actually only special cases of the general Euler equation mentioned above. By utilizing a second order linear differential operator, an example was constructed that disproves the conjecture, prevalent in the literature of the last fifteen years, that minimum variance estimators must necessarily be functions of sufficient statistics.

An estimator with minimum weighted MSE is developed, where the weights $\alpha(\theta)$ are functions of θ only, with or without a prescribed expectation function. If no isoperimetric condition is imposed, the limiting form of this estimator turns out to be the fiducial expectation of θ with a *priori* density $\alpha(\theta)$. In certain cases the solution $t^*(x)$ does not depend on the weights $\alpha(\theta)$ chosen.

Microfilm \$2.75; Xerox \$4.20. 76 pages.

AN INVESTIGATION OF BIORTHOGONAL POLYNOMIALS DERIVABLE FROM ORDINARY DIFFERENTIAL EQUATIONS OF THE THIRD ORDER

(Order No. Mic 61-2624)

Stanley Preiser, Ph.D.
New York University, 1958

Adviser: Professor Bernard Friedman

A theorem of Chaundy is exploited to prove the existence of only one ordinary differential equation of the third order of the type $\mathcal{A}(x)y''' + \mathcal{B}(x)y'' + \mathcal{C}(x)y' = \lambda y$ from which biorthogonal polynomials are derivable. The method of proof permits us to discuss differential equations of the first and second order as well and shows that no first order ordinary differential equation and only five second order ordinary differential equations of the above type will generate biorthogonal polynomials.

Microfilm \$2.75; Xerox \$3.00. 41 pages.

SAMPLING PROCEDURES INVOLVING UNEQUAL PROBABILITY SELECTION

(Order No. Mic 61-2269)

Jonnagadda Nalini Kanth Rao, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Herman O. Hartley

In sampling with unequal probabilities and without replacement, the customary estimator of the population total is

$$\hat{Y} = \sum_{j=1}^n \frac{y_j}{P_j}$$

where P_j is the probability for selecting the j^{th} unit in a sample of size n . The variance formula for \hat{Y} involves $P_{ii'}$, the probability for selecting both units i and i' in a sample of size n . It is recognized that by making P_j proportional to the 'size measure' x_j of the j^{th} unit, considerable reduction in the variance of \hat{Y} can be achieved if x_j and y_j are positively correlated. The methods available in the literature use 'revised size measures' to ensure this condition approximately, and involve heavy computations when n is greater than two and/or N is large. There is a simple sampling procedure well known to survey practitioners which ensures this condition exactly with the original size measures x_j . In this procedure, the N units in the population are listed in a random order and their measures of size x_j are cumulated and a systematic selection of n units from a random start is then made on the cumulative sum of the x_j . However, due to the mathematical difficulties involved in evaluating the probabilities $P_{ii'}$ for this sampling procedure explicitly in terms of P_j , it has not been exploited in the literature. In this dissertation, these mathematical difficulties are resolved through an asymptotic theory which provides compact expressions for the variance and the estimate of the variance of \hat{Y} in terms of P_j and y_j .

In Chapter III, expressions for P_{ii}^* are obtained for the cases $n = 2$ and $N = 3, 4$ and 5. As N becomes large, the exact evaluation of P_{ii}^* becomes cumbersome, and hence an asymptotic theory is developed in Chapter IV for the case $n = 2$ and in Chapter V for the case of general sample size n . An important feature of this sampling procedure is that it lends itself to the case of general sample size n unlike the procedures available in the literature.

The characteristic reduction in the variance of \hat{Y} through this sampling procedure as compared to sampling with replacement is clearly demonstrated. It is also proved that the asymptotic efficiency of the present sampling procedure is equal to that of Yates and Grundy iteration procedure of finding the 'revised size measures' which ensure that the probabilities P_j are proportional to x_j . However, the latter procedure involves considerable computations in finding the 'revised size measures.' In Chapter VI, several interesting problems in unequal probability sampling in general are considered.

Microfilm \$2.75; Xerox \$6.40. 132 pages.

SEQUENTIAL DECISION MODELS

(Order No. Mic 61-2432)

Yechezkel Henryk Rutenberg, Ph.D.
Case Institute of Technology, 1961

This study is concerned with mathematical representation -- that is, models -- of system behavior which is extended over time and is governed by probabilistic laws. The objective of the study is to derive optimal policies for such processes. Our interest lies in the class of sequential policies whose main characteristic is that they prescribe a decision procedure to be used in arriving at a decision in any possible contingency, rather than prescribe the actual decision to be taken.

The study is essentially divided into three parts: introduction, theory and applications to problem areas of interest in Operations Research.

The basic concepts required in the study of sequential decision models are developed first. This is followed by an investigation of parametric sequential decision models of systems which may be described by discrete state variables and a finite number of states. General solutions for both the discrete-time and continuous-time processes are obtained by formulating the problems in terms of linear programs.

The sequential approach to decision making is then applied to a class of replacement problems and to the problem of determining optimal service levels in queuing systems. A study of a coin-tossing game serves as an example of the sequential approach in the non-parametric case.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

SOME PROBLEMS IN THE ANALYSIS OF QUEUING SYSTEMS

(Order No. Mic 61-2433)

Maurice Wolf Sasieni, Ph.D.
Case Institute of Technology, 1961

This work starts with a brief discussion of some of the mathematical tools available for the analysis of queuing systems. Procedures for numerical computation of transient solutions for single counter models with Erlang service or inter-arrival times are presented. The multi-counter problems for Poisson arrivals and exponential services is also considered.

The problem of two counters with separate queues where arrivals join the shorter queue is analyzed for the case where each queue has a finite limit. Where steady state solutions exist for unlimited queues a computational procedure is indicated. Tables comparing this system with the well known two counter, single queue system and with two separate queues are given.

In Chapter V a model of double queue (such as at a taxi-rank) with impatient passengers and taxis is solved for the steady state probabilities; a possible application to inventory theory is suggested.

Lastly, the use of Laplace transforms is discussed for a single counter problem with arbitrary service time and Erlang arrivals.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

EXISTENCE AND UNIQUENESS FOR A THIRD ORDER NON-LINEAR PARTIAL DIFFERENTIAL EQUATION

(Order No. Mic 61-2602)

Chester B. Sensenig, Ph.D.
New York University, 1958

Adviser: Eugene Isaacson

The purpose of this thesis is to investigate the existence and uniqueness of a solution of the equation

$$\left[\frac{\partial}{\partial t} + U_y(x,y,t) \frac{\partial}{\partial x} - U_x(x,y,t) \frac{\partial}{\partial y} \right] [U_{xx}(x,y,t) + U_{yy}(x,y,t) - \lambda^2 U(x,y,t)] = 0$$

where x , y , and t are real variables; U is a real valued function of x , y , and t ; and λ is a positive real number. To simplify our notation we let $\Delta f = f_{xx} + f_{yy}$ when f is a function of x , y , and t . Then the equation becomes

$$(1) \quad \left(\frac{\partial}{\partial t} + U_y \frac{\partial}{\partial x} - U_x \frac{\partial}{\partial y} \right) (\Delta U - \lambda^2 U) = 0.$$

Equation (1) has arisen as an elementary mathematical model in meteorology. U plays the role of a stream function, x and y are position variables in two dimensional Euclidean space, and t is the time variable. We consider the solutions $x(t)$ and $y(t)$ of the ordinary differential equations $\frac{dx}{dt} = U_y(x,y,t)$ and $\frac{dy}{dt} = -U_x(x,y,t)$ to be

parametric equations for the curves followed by air particles in the xy -plane when U is a solution of (1). From this and equation (1) it follows that the Helmholtzian, $\Delta U - \lambda^2 U$, is constant along the curves followed by the air particles.

In this paper we will restrict ourselves to the consideration of the existence and uniqueness of a solution of

(1) in \mathcal{D} where

$$\mathcal{D} = \{(x, y, t) \mid -\infty < x < \infty, y \geq 0, 0 \leq t \leq c\} \text{ and } c \text{ is a positive constant, and we will use the physical model mentioned to aid us in prescribing the initial and boundary conditions.}$$

Let $h = \Delta U - \lambda^2 U$ where U is a solution of (1) in \mathcal{D} . Then if h behaves well enough at infinity, we can show that

$$(2) U(x, y, t) = \frac{1}{2\pi} \int_{-\infty}^{\eta \geq 0} \int g(x, y; \xi, \eta) h(\xi, \eta, t) d\xi d\eta - \frac{1}{\pi} \int_{-\infty}^{\infty} U(\xi, 0, t) g_{\eta}(x, y; \xi, 0) d\xi \text{ where } g(x, y; \xi, \eta)$$

is a Green's function. The right side of (2) depends on $h(\xi, \eta, t)$ and $U(x, 0, t)$. Since h is constant along the characteristic curves of (1), we see that h can be given everywhere in \mathcal{D} in terms of its values at points where characteristic curves enter \mathcal{D} , the characteristic curves of (1) being the curves described by the vector $[x(t), y(t), t]$ where $x(t)$ and $y(t)$ are solutions of the ordinary differential

equations $\frac{dx}{dt} = U_y(x, y, t)$ and $\frac{dy}{dt} = -U_x(x, y, t)$. In particu-

lar the right side of (2) can be expressed in terms of $h(x, y, t)$ at points where the characteristic curves of (1) enter \mathcal{D} and in terms of $U(x, 0, t)$. It therefore seems natural to prescribe the values of U on the xt -plane and to prescribe the values of $\Delta U - \lambda^2 U$ on the half plane $t = 0, y \geq 0$ and also at points on the xt -plane where $-U_x > 0$. In this thesis we show that when these prescribed values satisfy certain conditions there exists a unique solution of (1) in \mathcal{D} .

Microfilm \$2.75; Xerox \$6.20. 128 pages.

DIFFERENCE KERNELS

(Order No. Mic 61-1038)

Marvin Shinbrot, Ph.D.
Stanford University, 1961

Integral equations having the forms

$$\varphi(x) = \int_a^a k(|x-t|) f(t) dt, \quad |x| < a \quad (A)$$

$$\varphi(x) = (\int_{-\infty}^{-a} + \int_a^{\infty}) k(|x-t|) f(t) dt, \quad |x| > a \quad (B)$$

arise in a number of problems in applied mathematics. As examples, we mention only the problems of diffraction through a slit and of optimum filtering of a corrupted signal by a device having a finite memory.

In this paper, the question of existence of solutions of (A) and (B) is studied. The difficulty in answering this question is related to the fact that (A) and (B) are integral equations of the first kind, a kind of equation about which

very little is known. A fact that does not appear to be known, however, is that equations (A) and (B) can be reduced to integral equations of the second kind; through exploitation of this fact, it is shown that quite general conditions can be stated that give assurance that a solution exists.

The results are definitive, for it is shown that our conditions for existence are also necessary. Furthermore, a section of the paper is devoted to illustrations of the pathology of (A) and (B) when our conditions fail to be fulfilled.

Finally, we note that the method of proof of existence is constructive, so that, in principle at least, the solutions can be written down explicitly. Thus, the method gives rise to an infinite series that converges to the solution. It is easy to see from the method of construction of the series that, in addition to being convergent, it must be asymptotic to the solution for large values of the limit of integration a occurring in (A) and (B). This fact allows one to make a new derivation of the asymptotic form of the wave function for radiation impinging on a slit in case the ratio of wave length to slit width is small. It also allows a detailed discussion to be made of optimum filters with large, though finite, memories.

Microfilm \$2.75; Xerox \$4.20. 78 pages.

MIXED INITIAL-BOUNDARY VALUE PROBLEMS FOR SYMMETRIC LINEAR HYPERBOLIC EQUATIONS

(Order No. Mic 61-2596)

Harold Shulman, Ph.D.
New York University, 1958

Adviser: Professor Peter D. Lax

A method due to Friedrichs can be extended to yield the following theorem. Let $\partial u / \partial t + \sum_{i=1}^m A_i \partial u / \partial x_i + Bu = 0$ be a symmetric linear hyperbolic system with prescribed initial values on the plane $t = 0$ and prescribed boundary relationships on the plane $x_1 = 0$ among the components of the vector u . A sufficient condition that this problem have a solution is that the boundary conditions limit u to a subspace P such that $u^T A_1 u \leq 0$ for every u in P and P is maximal in this respect. In this paper the case $u = (u_1, u_2)$, $m = 2$, $B \equiv 0$ and the A 's are constant matrices is treated to yield the necessary and sufficient condition that the subspace P to which u is restricted by the boundary conditions contain no vector spanned by the positive eigenvalues of A_1 and that P be maximal in this respect. Fourier analysis, applicable to equations with constant coefficients is used and the solution is given an explicit representation. This may prove useful in deriving estimates on the rate of growth of the solution.

Microfilm \$2.75; Xerox \$3.00. 26 pages.

COHOMOLOGY THEORY IN GROUPS

(Order No. Mic 61-2607)

Bernard Sohmer, Ph.D.
New York University, 1958

Adviser: Professor Magnus

With the application of cohomology theory to groups, many old results were restated and several large theorems were produced about cohomology groups. Two problems seemed of interest. Firstly it seemed desirable to compute cohomology groups for a consequential group other than a cyclic group or a free group, and so the modular group M acting on the additive group of integer lattice points L in the plane was chosen. We took M acting both trivially and non-trivially. The following cohomology groups were computed. $H^0(M, L) = L(0)$ for trivial (non-trivial) action. $H^1(M, L) = 0$ for both modes of action. $H^2(M, L)$ is of order 2 if the action is non-trivial, and the direct sum of two cyclic groups of order four and two groups of order three if the action is trivial. Since the second cohomology group can be considered as the group of non-splitting extensions of M by L , depending on the mode of operation, we have that, for non-trivial action, there is only one such, and for trivial action there are 144.

A second point of interest is the well known theorem which states that all the cohomology groups of a free group, for order greater than 1, are null. This paper proves that if a group has all its cohomology groups, from some point on, null, then the group must be torsion free. Included after this statement are examples of large classes of groups which are torsion free but not free and whose second cohomology groups are proven not all null. It is not yet known whether this property characterizes free groups.

Microfilm \$2.75; Xerox \$3.00. 25 pages.

A CONSTRUCTION FOR SOLUTIONS
OF AN N-TH ORDER LINEAR DIFFERENTIAL
EQUATION IN THE NEIGHBORHOOD OF
A TURNING POINT

(Order No. 61-2983)

Gilbert Allan Stengle, Ph.D.
The University of Wisconsin, 1961

Supervisor: Wolfgang Wasow

The equation $(\epsilon D)^n x + \sum_{k=1}^n (\epsilon D)^{n-k} (a_k(t, \epsilon)x) = 0$ is considered in the case that the roots $\lambda_k(t, \epsilon)$ of the associated characteristic equation $\lambda^n + \sum_{k=1}^n a_k \lambda^{n-k} = 0$ all coalesce at $t = \epsilon = 0$. In this circumstance classical techniques of solution yield results only outside fixed t -intervals containing $t = 0$. Under certain additional hypotheses concerning the λ_k solutions are constructed having a larger domain of validity. This is accomplished by reformulating the problem as a nonlinear integral equation that can be solved by successive substitution to yield a series possessing strong asymptotic properties. The main result asserts that given the λ_k , for any $p > 0$, rational operations, exponentiations and integrations can be used to construct an approximate solution differing

from an actual solution by an error that is $O(\epsilon^p)$ uniformly in t and ϵ on an interval whose lower limit approaches 0 as $\epsilon \rightarrow 0$. For a large class of problems this limit decreases rapidly enough to permit construction of solutions on a complete t -interval containing 0.

Microfilm \$2.75; Xerox \$3.00. 56 pages.

FINANCING AND INITIAL OPERATIONS
OF NEW FIRMS

(Order No. Mic 61-2434)

George William Summers, Ph.D.
Case Institute of Technology, 1961

New firms frequently fail despite every appearance of ultimate success simply because high initial expenses use up starting capital before sales increase to the breakeven point. To investigate some of the problems involved, a simple model has been built of the financial position of a new business as a function of time.

The basic model assumes a linear growth of demand to a plateau and a production cost linear with output. Analytic arguments are given to justify the latter for segmented technologies. Variations of the model include introduction of costs of transition between production rates and a probability distribution of demand parameters.

Analytic expressions are found for the initial capital required to avoid failure in the basic model. Optimal production policies for minimizing initial capital requirements are found for the basic model and for one including transition costs. Policies for maximizing profit given unlimited capital are also found.

Finally for the case of probabilistic demand parameters, methods are given for calculating probability of success. For one decision variable affecting probability of success -- namely, length of loan period -- a procedure is indicated for calculating the value which maximizes the probability of success.

Microfilm \$2.75; Xerox \$4.40. 84 pages.

STRUCTURES OF CLASSIFICATION DATA

(Order No. Mic 61-2275)

Thomas Neil Throckmorton, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Oscar Kempthorne

The general purpose of this investigation was to study the possible types of structures which can arise from classification data and to develop simple rules by which the analysis of variance and expectations of mean squares can be obtained.

To this end the possible response structures are partitioned into two distinct classes, namely, complete structures and incomplete structures. A complete structure is one in which all factors, which are not related by nesting, form a complete cross classification within each given level of those factors which do nest them. Structure

diagrams, similar in form to the Hasse diagrams used to represent algebraic lattices, are then introduced and used to form a unique representation of all complete response structures.

A detailed investigation is carried out on the complete structures using techniques based upon derived linear models. This investigation is carried out under the assumption of equal sub-class numbers, primarily for the sake of mathematical simplicity, but also because most designed experiments satisfy this condition. Certain properties of the Σ 's, which are simply defined linear functions of the σ^2 's, are stated and proved and provide some insight as to why some of the later results hold.

For randomized experiments an additional relationship arises which is called random nesting. By introducing a slight modification to the previous structure diagrams, an experimental structure diagram is obtained. This diagram presents at a glance the structures of both the population of possible responses and the sample of observed responses, as well as indicating the exact randomization procedure used.

A series of theorems is then presented which leads to a simple rule for obtaining the analysis of variance and expected mean squares for any balanced complete experiment. A balanced complete experiment is any experiment which may be designated by an experimental diagram. The expected mean squares are given in terms of newly defined quantities called sample Σ 's. These sample Σ 's are simple linear functions of the population Σ 's and are specified by the diagram appropriate to that experiment. Several examples are presented which exhibit the broad applicability of the results obtained.

A brief investigation is made of Latin cube designs as an example of incomplete structures. It is seen that valid comparisons of mean squares are not available for the Latin cube in general. However, it is possible to obtain valid comparisons by restricting the cube to be in a special sub-class called symmetric Latin cubes. For the

symmetric Latin cube an orthogonal analysis of variance is obtained which partitions the $(t-1)^2$ degrees of freedom for each two-factor interaction into $t-1$ degrees of freedom completely confounded with a complementary two-factor interaction and $(t-1)(t-2)$ degrees of freedom completely clear of all two-factor interactions. These special Latin cubes may be used to obtain a $\frac{1}{t}$ of a t^4 fractional factorial design for any t , prime or non-prime.

Microfilm \$2.75; Xerox \$8.20. 180 pages.

FINITE DIFFERENCE APPROXIMATIONS TO SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

(Order No. Mic 61-2619)

Burton Wendroff, Ph.D.
New York University, 1958

Adviser: Peter D. Lax

In this thesis it is shown that finite difference approximations to certain initial value problems for hyperbolic partial differential equations may be obtained by replacing all partial derivatives by centered difference quotients. For systems in n independent variables, the stability and convergence of the approximate solution are demonstrated in a weak sense, and if $n = 2$, the approximate solution is shown to converge pointwise to the true solution. These results are obtained by the energy method of K. O. Friedrichs. The energy method is also used to show that the solution of a certain system of differential-difference equations obtained from the transport equation converges to the solution of the transport equation.

Microfilm \$2.75; Xerox \$3.00. 32 pages.

MINERALOGY

MINERALOGICAL ANALYSES OF A BROWN SOIL AND A CHESTNUT SOIL OF THE REPUBLIC OF IRAQ

(Order No. 61-2955)

Augustine Booya Hanna, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Marion L. Jackson

A Brown soil and a Chestnut soil developed from fine-textured alluvium on ancient terraces of northern Iraq, under a semi-arid climate with an average annual precipitation of 25 inches, were subjected to mineralogical analysis. The minerals were identified in each of several particle size fractions by X-ray diffraction analysis, electron microscopy, differential thermal analysis and intercalation for 1:1 dioctahedral layer silicates. The mont-

morillonite and vermiculite minerals were determined by mono- and duo-interlayer glycerol sorption methods for planar specific surface. Illite was determined from the percentage potassium in the clay fractions. Kaolinite was differentially dissolved in half normal sodium hydroxide after preheating at 525° C. Attapulgite was determined by differential dissolution analysis and electron microscopy. Hydroxyl water lost from 350-540° C was used to calculate the percentage of montmorillonite-chlorite intergrade, and from 540-900° C, that of chlorite.

The results may be summarized as follows:

The percentages of nontronitic montmorillonite of the Brown soil decrease from 70, 49 and 27 respectively in the fine, medium and coarse clay of the A₁ horizon to 59, 40 and 13 in the lower B_{ca} horizon. The cation exchange capacity of the fine, medium and coarse clay of the two horizons follows the same trend, from 101, 80 and 41 meq per 100 gm respectively in the A₁ horizon to 90, 69 and 32

meq per 100 gm in the B_{ca} horizon. The percentage of illite increases from 13, 19 and 28 respectively in the fine, medium and coarse clay fractions of the A_1 horizon to 18, 25 and 31 in the B_{ca} horizon. Chlorite in the coarse clay increases from 12 percent in the A_1 horizon to 17 percent in the B_{ca} horizon. Kaolinite in this fraction is 7 percent. Vermiculite ranges from 7 to 10 percent in various fractions. Attapulgite is about 7 percent in the medium clay of the A_1 horizon and 12 percent in the B_{ca} horizon. The montmorillonite-chlorite intergrade expands with glycerol to 18A, dropping to 14A on driving the glycerol out. Its hydroxyl interlayer dehydrates at about 500°C accompanied by disappearance of 7.2A and 3.55A peaks and enhancement of the 10A peak. This mineral is about 6 percent in the clays. Regularly and randomly interstratified systems of expandable layer silicates with chlorite and illite exist in the clays and silts.

The particle size distribution of the Brown soil was rather uniform throughout the profile, and was bimodal.

The Chestnut soil contains 58 percent montmorillonite in the fine clay and 8 percent in the fine silt; illite is 18 percent in the fine clay and 36 percent in the fine silt.

The thermal stability of the attapulgite structure was found to decrease in the presence of organic solvents such as acetone or alcohol. Substitution of these for water in the channels, with Na^+ or H^+ as exchange cations, is presumed to cause locally enhanced thermal shock.

In conclusion, expandable layer silicates predominate in the finer clay fractions of the Brown and Chestnut soils. Illite and chlorite are more abundant in the coarser fractions of the clays and silt, and in the deeper horizons compared to the surface soil.

Quartz, illite and chlorite predominate in the silts, with some amphibole, attapulgite and feldspars. The sand is mainly quartz. The lime, calcite, occurs in all fractions of the soils, predominating in the fine silt. Attapulgite concentrates in the medium clays; its decrease in the surface horizon probably results from transformation into montmorillonite, while the decrease in illite results from removal of the interlayer potassium by soil forming processes, concurrent with expansion of the lattice to form vermiculite and montmorillonite.

Microfilm \$2.75; Xerox \$7.40. 159 pages.

DIFFERENTIAL DISSOLUTION ANALYSIS OF CLAYS AND ITS APPLICATION TO HAWAIIAN SOILS

(Order No. 61-2957)

Isao Hashimoto, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor Marion L. Jackson

Analyses of soil clays are carried out by several independent physical and chemical methods because each method has limitations. Differential dissolution methods are being developed based on crystal structure characteristics of minerals, the basis for mineral classification. Dissolution analysis provides not only a means of obtaining the chemical composition of labile minerals but also provides samples free of these materials for analysis of more

resistant minerals. Development of dissolution techniques involves selection of specific reagents, establishment of optimal conditions for reaction, and recognition of their limitations.

The objectives of this investigation were to develop a method for differential dissolution of amorphous constituents from soil clays and of the kaolinite plus halloysite components of crystalline soil clays.

The results may be summarized as follows:

Half normal NaOH solution was chosen because of its rapid and extensive dissolution of both silica and alumina, the two major constituents of clay minerals. Use of 2% Na_2CO_3 solution gave less complete dissolution.

Boiling for as little as 2.5 minutes in the NaOH solution dissolved a large quantity of allophane-like materials and free silica and alumina from clays of some montmorillonite-rich soils of Hawaii, provided the ratio of clay to solution volume was kept less than 100 mg to 100 ml. Subsequent dithionite-citrate-bicarbonate treatment removed the released iron. Various typical allophane specimens were completely dissolved by this procedure.

Reprecipitation of dissolved silica occurred with prolonged digestion or higher sample to solution ratio. Digestion for 80 minutes dissolved 50% of Georgia kaolinite and 25% of Wyoming montmorillonite, but only a small quantity of crystalline minerals dissolved during the short digestion period adopted. Halloysite specimens appeared somewhat unstable, however. Gibbsite dissolved very readily together with the amorphous constituents.

Marked improvement of x-ray diffraction patterns of clays resulted after the removal of amorphous materials. A few percent of crystalline components were identified in the clay fraction of allophane from soils and deposits.

After dehydroxylation treatment, halloysite and kaolinite became amorphous and were dissolved by the same differential dissolution procedure. Dissolution of kaolinite against preheating temperature was essentially identical to the dehydration curve. A sharp break occurred at 500°C. Some temperature variation in a furnace space is common and thus 4 hours of heating at 525°C should be employed for dehydroxylating kaolinite. Heating weight loss data also correlated closely with dissolution. Heat-stable (aluminous) montmorillonite and chlorite were only slightly dissolved. Iron-rich vermiculite and nontronitic montmorillonite were partially dehydroxylated by the heating process and dissolved accordingly. The process of heating lowered the solubility of amorphous materials and gibbsite.

After dehydroxylation, the ferruginous clays of Hawaiian montmorillonitic soils released an additional amount arising from kaolinite and halloysite, helpful in determining these minerals. A considerable amount of iron from nontronitic montmorillonite was extracted also which necessitated a refinement in the allocation.

Digestion in 2 normal HCl had very little effect on kaolinite samples while the same treatment dissolved Colorado vermiculite and a nontronitic soil montmorillonite completely. Relatively labile halloysite from Hawaii was highly susceptible to dissolution by such a treatment. The removal of heat-unstable 2:1 layer silicates was desirable to concentrate the kaolinite and halloysite. Photochemical reduction of iron in 0.125 molar oxalate buffer was less severe than the HCl treatment but showed no specific effect on iron-rich minerals.

The proposed differential dissolution procedure using

a NaOH solution is rapid, simple and fairly quantitative, through simple analysis of dissolved elements. The removal of amorphous constituents and kaolinite plus halloysite should greatly improve the accuracy of analysis of the remaining components by the conventional methods, and is particularly helpful in evaluation of the 7 Å diffraction spacing of clays.

Microfilm \$2.75; Xerox \$6.00. 122 pages.

**INTERRELATIONS AMONG PETROGRAPHIC,
TEXTURAL, AND OIL RESERVOIR PROPERTIES
IN THE CHIPMUNK SANDSTONE.**

(Order No. Mic 61-2393)

Jerrold Marvin Pachman, Ph.D.
The Pennsylvania State University, 1961

Two reservoir sand types occurring within the (Devonian) Chipmunk sand oil pool of southwestern New York and northwestern Pennsylvania differentiated and selected on the basis of porosity vs. log permeability relationships have been petrographically and texturally analyzed so as to (1) effect a comparison between each class of measurements from one type to the other, (2) derive economical linear regression functions of oil reservoir properties on the petrographic and textural properties of each type, (3) determine the minimum number of measurement classes required in order not to "significantly" lower the amount of information provided by them all and (4) derive an economical linear function which maximizes the probability of correctly assigning a sample to its parent population on the basis of the measured variables.

It is shown that the reservoir properties, porosity and log permeability, are not independent of "mineral" composition. The low permeability sands contain significantly greater amounts of silica cement than the high permeability type, while the latter possess a significantly greater proportion of "feldspar." Due to the otherwise close similarity between the two reservoir types, silica cement and carbonate cement seem to govern whether a sand sample has favorable or unfavorable reservoir properties.

A mixed model nested classification analysis of variance indicates that the two sand types are homogeneous with respect to quartz long axes in thin section (converted to phi units) although significant differences exist between thin sections (within sand types) and between fields (within thin sections) for a given rock type. Thus, two levels of small scale "fabric" heterogeneity are suggested. The degree of sorting remains unchanged across rock types.

A principal components analysis of the high permeability sand data achieves a moderate degree of economy in variates (80.2 per cent of the total variation accounted for by seven components, 59.3 per cent by five), but did not result in any identifications with geologic processes.

The non-significant (with probability $1 - \alpha$) of per cent oil saturation on all petrographic and textural properties are presumed to be due largely to the fact that these Chipmunk sands have been water flooded, thereby upsetting the original "balance" between petrography and this particular oil reservoir property. The most economical porosity regression relationships include carbonate cement as an independent variable in the low permeability sands and silica cement, "feldspar," and carbonate cement in the high. The variation in porosity attributable to these regressions is not significantly different from 62.4 per cent and 54.6 per cent respectively.

No significant regression of log permeability on the complete list of twelve independent variables exists in the "poor" sands, while a reduced equation for the "good" group contains only two independent variables, silica cement and "feldspar" and accounts for a proportion of the variation in log permeability not significantly different from 43 per cent.

In order to maximize the probability of correctly assigning any sample to its parent population on the basis of petrographic measurements alone, it is necessary only to consider its per cent silica cement. Sixty-seven and eight tenths per cent of the Chipmunk samples analyzed in this investigation have been correctly classified using the silica cement criterion.

The need for more inclusive probability statements in quantitative petrography is stressed and a general outline for future research in this regard is presented.

Microfilm \$2.75; Xerox \$5.20. 104 pages.

MUSIC

**KEYBOARD INSTRUCTION BOOKS OF
THE EIGHTEENTH CENTURY**

(Order No. Mic 61-2736)

Marvin John Bostrom, Ph.D.
University of Michigan, 1961

This study was undertaken to furnish a guide to eighteenth century instruction books for stringed keyboard instruments. In addition it proposes to investigate the various means used in these treatises to teach people how to play these instruments. The type of treatise chosen for this study was that containing mostly explanatory text with

only a small amount of practice pieces. Treatises or sections on thorough bass and ornamentation were eliminated because these subjects have already received adequate attention in other studies.

The first part of the study serves as a description and evaluation of the books, giving various details of content that might be helpful to persons interested in locating specific information. Included among the sixteen treatises chosen for the study are certain works that are familiar to music scholars as well as works that are little known. All are observed and compared for organization of material.

The second part is a study of the pedagogical approach

to the learning of keyboard performance. The first chapter of this part deals with general principles, discussing advice given directly to parents and pupil, comments on selecting and caring for the instrument, requirements of the student, attributes of a teacher, and certain techniques of teaching. The next chapter focuses upon the manner in which these treatises present the basic fundamentals of music. Included are such items as basic elements of notation, time, and simple theory of music. Following is a chapter on the teaching of technique in playing. The student's position and movement at the keyboard is discussed, and considerable attention is paid to the subject of fingerings. The last chapter of the second part deals with instruction in how to properly interpret music. The aspects of tempo, rhythm, dynamics, articulation, and phrasing are considered in their relationship to tasteful and expressive performance.

The third part is a music supplement consisting of teaching pieces, most of which are drawn from the treatises. A varied selection was made in order to give a cross-section of typical practice material as well as of the forms commonly used.

It was found that most of the books were intended to be used beneficially by both the teacher and the pupil. The study produces facts that are useful today in the study of music from the period covered. Furthermore, it describes the teaching procedures of the eighteenth century, giving a criterion by which we can compare present-day practices.

Microfilm \$2.85; Xerox \$9.90. 220 pages.

**THE ARIA TECHNIQUES OF GIACOMO PUCCINI:
A STUDY IN MUSICO-DRAMATIC STYLE.**

(Order No. Mic 61-2548)

Reverend Gennaro Anthony D'Ecclesiis, Ph.D.
New York University, 1961

There has been no detailed analytic study made of the aria techniques of Giacomo Puccini. Although there exists a great deal of literature on the composer, most of it is biographical. Even where writers and critics discuss Puccini's musical style, for the most part their observations are somewhat general in nature. Mosco Carner has contributed a truly scholarly and exhaustive work on Puccini entitled, Puccini, A Critical Biography (London, 1958). Nevertheless, not even in this work does one encounter a sufficiently complete account of the musico-dramatic qualities of the arias. The present dissertation was undertaken with a view to filling this need. The arias examined were those found in all of the Puccini operas with the exception of Le Villi and Edgar, neither of which enjoyed international success. The investigator, in his study, has attempted to avoid useless duplication of material adequately covered in various other sources on the composer.

In approaching the problem it was immediately evident that some working definition of the term "aria" was necessary. Having arrived at a definition, the operatic solo songs that met the requirements were designated as arias. The arias were then studied from the angle of form, melody, harmony and orchestration as well as for their dramatic importance.

The study of the form was made to determine whether

Puccini hewed to the usual forms, modified or abandoned them. The arias were also analyzed melodically to ascertain their general contour, special characteristics, tessiture and allied melodic elements. In the elaboration of the tessiture the technique employed was that outlined in Grove's Dictionary of Music and Musicians under the heading "Singing." This entailed a graphic representation of each aria based on the range of each voice and the tones allotted to it. The data comprise Appendix II of the dissertation. The purpose of the analysis was to try to discover the "constants" and the "variables" in Puccini's melodic style.

The harmonic idiom employed by Puccini in the arias was analyzed in an effort to determine to what extent it specified his particular type of aria. The openings, closings and the body of the arias were considered separately.

Puccini's orchestration for the arias was also examined and certain orchestral devices recorded. The over-all texture of the orchestration as well as the choice of instruments for special effects were explored.

The dramatic aspects of the arias were studied from both the musical and textual angles. The several musical means that Puccini used to integrate the aria into the dramatic situation being developed were investigated. Finally, the inherent value of the aria text was studied in relation to character portrayal and plot development.

This study has led the investigator to conclude that Puccini, despite his eclecticism, created a personal and unique type of aria. By using and modifying the forms of an earlier period he was able to make them a more vital part of the dramatic development of the play. With an ear attuned to every nuance in the world of music, Puccini was able to bend the techniques of the romantic, impressionistic or modern idiom to his own musico-dramatic purposes. He did this without betraying his basic Italian heritage with its insistence that the voice be the primary vehicle for the projection of character.

The relative uniformity of the character types that Puccini developed best can be traced to a personal psychological predisposition rather than to any musical limitation. He was the musical spokesman for characters who were gentle, tender, loving, long-suffering. Within this specialized or, if you will, circumscribed emotional area Puccini was almost without peer among his contemporaries.

Microfilm \$3.50; Xerox \$12.15. 269 pages.

**ARIA DA CAPO, A CHAMBER OPERA
IN ONE ACT. ADAPTED FROM THE PLAY
BY EDNA ST. VINCENT MILLAY.
[with] VOCAL-PIANO SCORE.**

(Order No. Mic 60-5650)

LeRoy Victor Eitzen, Ph.D.
State University of Iowa, 1960

Chairman: Associate Professor Philip Bezanson

The motivation to write an operatic piece arose from several impulses, some quite erratic at the outset. One was an attempt to hold on to a love of musical sounds, old and new, which seemed to be leaving me. Another was an uneasiness about the aura of sanctity and nobility that

clung to music in spite of strong forces tending to dispel it. Another was the recognition that a fair-sized repertory of American concert music in a serious vein was getting conspicuously little use, even that under protest, while the American manner in theater music, at various levels, seemed on the verge of a great demand. Study and composition resulted in a piece which is, I hope, less superficial than it seems at first. An opera buffa derivative, it has served for good learning under a demanding teacher, and will hopefully be a respectable American campus work and encourage student composers toward more natural counterparts in the near future.

The history of opera contains much that is largely entertainment business, but the one man who demanded the most rapt attention to his operas surely gave his devotees a kind of false religion. In the reaction against it, the concept of absolute music became another one, but now people who have irrepressible urges to play and sing pay the expenses the cult of listening once bore.

Today, communicative words do not hurt the popularity of any good music nor of some bad music. If the words are ludicrous or obsolete and hypocritical, properly tempered music above and around them can still give a good occasion. Only disproportionate devotion to pure instrumental sound, however well-crafted, seeks perversion. Parodies come because the not-God has been worshipped.

In this attitude, we cast about for a tale that would allow effective musical moments in a context of contemporary light-heartedness, and yet grant an adult audience a brief rapport with a truth already in its bones, and spin a study line that would leave a spectator some honor if he brought his children. At the suggestion of Professor Harold Shiffler of the drama faculty, we used the ironic morality play Aria da Capo by Edna St. Vincent Millay.

The title would suggest the use of set forms in number-opera style, but except for the duet between Corydon and Thyrsis in the opening of the second scene, the musical texture and line is dictated largely by thematic and dramatic considerations.

There is frequent use of the piquant, barbed sound, with perhaps an over-use of the added-note and off-note mannerisms. Some passages have been called "exotic." By and large, a natural musical speech rhythm has been used; we have found that even meticulous reproductions of natural speech, prolonged, only aids musical processes, if they do not fail for other shortcomings.

Generally, the piano's most conspicuous uses are in the interruptions between the scenes.

I hope this contribution to musical activity is proportionate to my talent, and that it might find some use.

Any interested directors will please note that at this time the performance rights would be handled by the composer as regards both the music and the play, which is the copyright property of Brandt and Brandt, New York.

Microfilm \$3.30; Xerox \$11.50. 254 pages.

Part I: Doctoral Essay.

THE STUDY AND PERFORMANCE OF
THREE EXTENDED CHORAL WORKS:
MASS IN G, BY FRANCIS POULENC
MISSA BREVIS, BY DIETRICH BUXTEHUDE
STABAT MATER, BY ANTONIO CALDARA.

and Part II: Original Composition.

INTROITS AND GRADUALS FOR HOLY WEEK
FOR CHORUS AND WIND INSTRUMENTS.

(Order No. Mic 60-5655)

James Erwin Fritschel, Ph.D.
State University of Iowa, 1960

Chairman: Professor Herald Stark

This study covered two areas — the creation of music and its re-creation. The creative aspect is present in the form of an original composition for wind instruments and chorus, the Introits and Graduals for Holy Week, which was performed as part of a series of concerts. The re-creative aspect was involved in the performance of three choral programs, from which three extended works were selected for individual and collective discussion in the dissertation, in the form of historical and analytical surveys. These works are: the Mass in G by Francis Poulenc, the Massa Brevis by Dietrich Buxtehude, and Antonio Caldara's Stabat Mater.

A marked change of emphasis and outlook have been observed in the works of Francis Poulenc since 1936, coinciding with his renewed interest in religion. Since that time the music of Poulenc has been markedly more serious in nature. The Mass in G represents the peak of Poulenc's sacred a cappella works. Its idiom is decidedly contemporary, though it is influenced by the work of the French Renaissance composer, Claude le Jeune. There is one other contemporary a cappella Mass of equal significance, Vaughan Williams' Mass in G Minor. Though the two Masses both draw upon the Renaissance for inspiration, Vaughan Williams' work seems to this writer much the more serious of the two. Poulenc's work, while not flippant or irreverent, is somewhat light-hearted and care-free. Its style is harmonically rather than contrapuntally conceived.

In his Massa Brevis Dietrich Buxtehude made an apparent attempt to emulate the sixteenth-century "Palestrina" style. His use of sixteenth-century techniques such as "pervading imitation" and the avoidance of homophonic writing do not, however, hide the fact that the work is seventeenth-century in origin. The strength of the tonal center, extensive use of chromatics, and addition of the continuo mark this as a seventeenth-century piece.

In contrast to the stile antico of Buxtehude, Antonio Caldara wrote the Stabat Mater in the contemporary concertato style. He employed most devices typical of the style save the use of multiple choruses. The work is notable for its singability and skillful use of instrumental support. The presence of several augmented-sixth chords in this composition is one of the features that tends to mark it as a product of the mature Baroque musical style. A melodic trait peculiar to Caldara is noted in the Stabat Mater, the leap downward of a diminished fourth. This occurs in minor keys only and is a leap from the third tone of the scale down to the leading tone.

The problems in the preparation and performance of

choral works are treated in three broad areas: (1) accuracy and precision, (2) subjective and objective interpretation, and (3) conducting techniques. These are discussed in the light of the director's responsibility, problems, and possible solutions in each area.

The original composition for chorus and wind instruments, Introits and Graduals for Holy Week, was based on the Introits and Graduals for Palm Sunday, Good Friday, and Easter as found in the American Lutheran Hymnal. The work emulates the concertato style and uses an instrumentation of two trumpets, two French horns, trombone, tuba, bass clarinet, and bassoon. The Easter section is a chorale motet based on the chorale tune, Christ ist erstanden, while the other two sections are formally more free.

Microfilm \$2.75; Xerox \$8.40. 182 pages.

THE THEORY AND PRACTICE OF ORCHESTRAL CONDUCTING SINCE 1752

(Order No. Mic 61-1832)

Elliott Washington Galkin, Ph.D.
Cornell University, 1960

The purpose of this dissertation is to study the development of conducting in general and orchestral conducting in particular as a specialized craft. The procedure employed has been to collect and interpret information from primary sources such as dictionaries, textbooks, memoirs, commentaries in periodicals, biographies and autobiographies of the period concerned, as well as to examine the rare existing studies about the history of conducting. Among the best sources are not casual letters or regular journalistic reports, but those relatively rare and systematic writings by musicians who described foreign musical events. Spohr's reports about concerts in London and Paris, Chorley's accounts of his travels throughout Europe, and Burney's writings are notable examples. The quasi-publicity material such as that published in the Allgemeine musikalische Zeitung (Leipzig) in the 1800's to acquaint the public with musical activities in the various towns is also informative.

The history of conducting has been inadequately treated by writers; the only genuine attempt to study the subject from a scholarly point of view is George Schünemann's Geschichte des Dirigierens (1913). However the work is out-of-date and also contains inaccuracies in the quotation of primary sources; in addition, since Schünemann was a choral conductor, the instrumental phases of conducting do not receive as detailed treatment as the vocal developments.

It is obvious that a history of conducting must also include an examination of the general artistic climate as it relates to both the orchestra and the conductor. Thus this study also treats such subjects as the growth and tastes of audiences, methods of artistic pedagogy, technological advances in the manufacture and perfection of instruments, as well as the origins and developments in time-beating procedures, early conducting and conductors, rehearsal practices, sizes, shapes, and instrumental arrangements of orchestras, and finally, an examination of modern-day conducting.

The thesis is divided into ten chapters. The first of-

fers background information about the development of (1) the orchestra as a somewhat standardized organization of instruments; (2) orchestration as a specialized technique; and (3) the increase of rhythmic complexity in orchestral writing. The succeeding chapters examine specific descriptions of time-beating, the conductor, and conducting. The arrangement is one in which these chapters are alternately devoted to descriptions from general sources and specialized treatises; both are compared to actual reports of performance practice. Finally, the important conducting handbooks since 1844, such as Berlioz, Wagner, Blitz, Schroeder, Weingartner, Scherchen and Rudolph are studied and evaluated from practical points of view, and the time-beating principles common to all these works are traced. It is shown that these principles developed in a systematic fashion. In conclusion, a study of the technical as well as general aspects of modern orchestral conducting are offered.

There is an extensive bibliography, and an appendix in which many diagrams illustrating the size of various orchestras since the early nineteenth century, and their instrumental disposition are presented.

Microfilm \$8.35; Xerox \$29.70. 659 pages.

THE RELATIONSHIP BETWEEN CERTAIN PERSONALITY CHARACTERISTICS AND ACHIEVEMENT IN INSTRUMENTAL MUSIC

(Order No. Mic 61-2553)

Lionel Kaplan, Ph.D.
New York University, 1961

Millions of neophyte musicians are engaged in the study of band instruments. There is little agreement on the method of selecting students for instrumental instruction. Various ways include the use of musical aptitude tests, audition, I. Q., and the consideration of certain physical characteristics. No extensive study has been made of the nature of the music student. This investigator felt that personality might play a role in choosing this area of activity and be related to the level of achievement. The identification of potentially capable students would afford new reservoirs of talent which eventually would serve to rejuvenate an important segment of our culture.

The design of the study was calculated to reveal the relationships between certain personality characteristics (profiles) and achievement in instrumental music. A sample of approximately 300 instrumental music students, and a comparable group of non-music students were selected at random from six New York City high schools. Both groups were given the Manifold Interest Schedule to ascertain personality patterns, and the results were compared. Achievement in instrumental music was measured by the Watkins - Farnum Performance Scale. Personality patterns were related to levels of performance. Category - responses were also compared for music and non-music students as well as for high and low achievers in music. Similar comparisons were made on the basis of instrumental classifications (i.e. woodwind and brass). All groups were divided according to sex.

An examination of related studies revealed little or no

agreement regarding the validity of criteria used to measure musical aptitude and achievement, in the relationship between I. Q. and aptitude or between physical characteristics and achievement. Recent research conducted primarily by psychologists seemed to indicate that personality factors are strong determinants of choice of, and success in, certain vocational and academic fields.

The collected data were subjected to appropriate statistical processing. Comparisons between various groups of students, on a profile basis, were affected through the use of the Chi-square test. To determine whether interest in any specific academic or non-academic category served to distinguish one group of students from another, comparisons of mean scores of category - responses were undertaken and a t test was used.

The results showed that more music students and high achievers, of both sexes, in instrumental music tend to be like profiles B, D, and F, than do the non-music and low achieving students in this area. The latter groups tend to be more closely associated with the characteristics of profile C. Profile F may be described as "self confident," B as "self controlling," D as "intellectualizing," and C as "fearful."

High interests in specific categories were revealed in some comparisons. Notable were the associations between music students and high interest level in the non-academic category of Leadership in the academic category called Music.

While the number of students who fell into profiles which served to distinguish one group of students from another at the .05 level of significance was always less than a majority, the likelihood of a correct prediction regarding their similarity to music students, or level of achievement, was always better than could be expected by chance.

For those students who fall into profiles which do distinguish, more effective guidance, based on the results of the Manifold Interest Schedule, may be offered concerning the decision to study instrumental music, which type of instrument to choose, and what level of achievement may be expected.

No statement in the study should be construed as approving the use of an interest inventory as a basis for rejection of students who request instrumental instruction.

Microfilm \$2.75; Xerox \$8.80. 195 pages.

PART I: CONCERT OVERTURE FOR ORCHESTRA.

PART II: THE LITTLE BLACK BOY FOR SOPRANO SOLO, STRING QUARTET, AND CLARINET, TO THE POEMS OF WILLIAM BLAKE.

(Order No. Mic 60-4383)

Paul Edwin Karvonen, Ph.D.
State University of Iowa, 1960

Chairman: Associate Professor Philip Bezanson

The Concert Overture follows the general outlines of a sonata allegro movement with a somewhat freer treatment of the form especially in the recapitulation section.

The work opens with the strings playing a rather indecisive motive that is, at first, confined to a narrow range of intervals. With the successive entries of the woodwind and brass sections, however, the motive gradually develops a wider melodic span. The second theme, of lyrical character, is announced by the strings, which are interrupted from time to time by brief interjections from the winds and brass. In the development section both themes are treated in various ways, with the first one often providing a contrapuntal setting for the second. A climactic moment is reached in the beginning section of the recapitulation, and from that point on the first theme gradually assumes greater importance. In the coda, built mainly on the first motive, an increase in tempo together with more assertive brass and woodwind ejaculations brings the work to a strong and affirmative close.

The Little Black Boy is a setting of one of William Blake's Songs of Innocence. It is for soprano voice, string quartet, and clarinet. This work has been written with a view to allowing the text to be heard clearly at all times, minimizing as much as possible the general tendency of the strings to overpower or "mask" the voice. The clarinet often has a rather florid line as a counterpart to the voice. The interludes between the various stanzas, together with the introduction, provide opportunity for the instruments to be heard alone and offer contrasts in texture and dynamics.

Microfilm \$2.75; Xerox \$3.60. 63 pages.

THE MADRIGALS OF PETER PHILIPS. (VOLUMES I AND II).

(Order No. Mic 61-2782)

Frank Cogswell Pearson, Jr., Ph.D.
University of Michigan, 1961

Contemporary opinion accorded Peter Philips (ca. 1561-1628) high esteem as an organist and composer of madrigals and motets; but time has reduced Philips to a mere name in music histories, and present-day evaluation is based on few compositions. This thesis seeks better understanding of Philips' style through transcription and study of the compositional techniques of his seventy-eight known madrigals. These probably furnish a truer picture of fundamental compositional practices in the late madrigal than do works by masters endowed with more originality. Since Philips' madrigal writing has a genre style, the twenty-four highly typical madrigals chosen for Volume II suffice for illustrative purposes.

Chapter I summarizes available biographical information on Philips, an English Catholic who left England in 1582, spent three years in Rome, traveled with Thomas Paget in Spain, France, and the Low Countries, all before settling in 1590 in Antwerp. Although Philips' marriage was known, possible contemporary reference to a daughter Marie is noted herein for the first time. Philips' madrigals, his first published compositions, all appeared between 1591 and 1603, during his residence in Antwerp, later in Brussels after his 1597 appointment as organist at the archducal court of Albert and Isabella. After 1603, no new compositions appeared until 1612, the beginning of the period of Philips' concentration on sacred composition. Chapter II discusses sources and editions used for this

study. Chapter III is an analysis of the music. Philips consistently uses a C time signature, vitalizing typical sixteenth-century rhythmic patterns with frequent fluctuation between semiminim and minim time units. Animation results from use of short note-values, including fusas supplied with separate syllables. Duple rhythmic groups predominate, intermixed with some triple, both defined by agogic accents in homorhythmic writing. In imitative writing, most entries are spaced to retain duple grouping. Melodic usage is conservative, with the chromatic semitone occurring only eight times. Philips exceeds E-flat and G-sharp only twice in his frequent notated accidentals, often used to provide major chords where minor ones normally appear. Philips' basic harmonic language comprises root position and first-inversion triads. Only rarely does a non-essential augmented sonority appear. Six-four sonorities appear frequently, through predilection for consonant fourth patterns. Dissonance treatment is conservative, mainly limited to unaccented ornaments and suspensions. Modal centers are mainly Mixolydian and transposed Dorian. Use of the leading tone in chords within phrases, chord root progressions by fourths and fifths, and portions of phrases alternating between dominant and tonic show tonal influence; while retention of chord root progressions by seconds and thirds and close proximity of natural and sharp scale sevenths reveal continued modal influence. Authentic cadences with four-three suspensions predominate. Plagal, VII6, and Phrygian cadences also occur. Chordal, semichordal, and imitative textures alternate freely. Even the imitative texture is influenced by vertical considerations. Pitch and chord repetition, chordal opening sections, syllabic treatment, and simultaneous cadences in all parts are characteristic. Imitative writing is frequently complex and busy, employing stretto consistently. Antiphonal writing is characteristic of the eight-voice madrigals. Madrigal settings are largely through-composed, with most repetition immediate. Only one madrigal repeats melodic material from a previous *parte*, and Philips experiments once with an incomplete cadence followed by a measured pause between *parti*.

Chapter IV deals with the forms of the amorous and pastoral texts, thirteen of whose authors were identified. Musical settings follow the general spirit of the text line, but word painting appears occasionally.

Historically, Philips' madrigals gain him little prestige for originality, but reveal competent, attractive writing, justifying the acclaim of his contemporaries, while furnishing additional music for performance and study of sixteenth-century compositional techniques.

Microfilm \$5.40; Xerox \$19.15. 423 pages.

**VERISMO OPERA AND THE VERISTS
[with] SUPPLEMENTARY VOLUME:
ANNOTATED VOCAL SCORE
OF PUCCINI'S TOSCA.**

(Order No. Mic 60-4695)

Kenneth Gustave Schuller, Ph.D.
Washington University, 1960

Chairman: Lincoln Bunce Spiess

The term verismo was first used to designate an Italian literary school headed by Giovanni Verga (1840-1922) and Luigi Capuana (1839-1915). The same term was later applied to an operatic movement which began with the production of Cavalleria Rusticana in 1894 and flourished until the death of Puccini in 1924. There is considerable divergence of opinion among writers on the subject as to what the word verismo means as it applies to opera. It is variously defined as a nationalistic school, a historical period, a style of musical composition, a group of composers (variously and contradictorily identified), or an esthetic philosophy.

Since verismo was originally used to describe a literary style, most authorities classify as veristic only those operas whose librettos have the same characteristics as verismo literature. Most definitions of verismo opera cite Cavalleria Rusticana and Pagliacci as models, but each definition emphasizes certain, even different elements of these works while it ignores still other facets which are equally or even more important. One finds only a few operas which conform to all the diverse definitions given for veristic opera; so few, in fact, that a term to classify them seems superfluous. Nevertheless, a change of style occurs in Italian opera with Cavalleria Rusticana, which does justify distinguishing the new type of opera from the style of the preceding period.

The purpose of this research was to determine how verismo operas differ from those of the preceding period, and to resolve the apparent contradictions which exist in discussions of the subject. To find the characteristics of the new style, representative operas, principally by the five composers who are most generally classified as verists, were examined from both a literary and a musical standpoint. These composers, whose works epitomize the verismo movement and summarize the period, are Pietro Mascagni (1863-1945), Ruggiero Leoncavallo (1858-1919), Francesco Cilea (1866-1950), Umberto Giordano (1867-1948), and Giacomo Puccini (1858-1924).

This investigation revealed that the one common characteristic found in all verismo opera is a dramatic, realistic musical interpretation of the text. It is the manner in which the composer sets his text, rather than the nature of the text itself, which represents the distinguishing feature of verismo opera. The verists, unlike their romantic predecessors, based their music on dramatic principles rather than on principles of musical form and content. Puccini's Tosca was subjected to a detailed analysis which was correlated with an annotated score. This analysis revealed the great extent to which dramatic logic governs the composition of verismo opera.

Puccini's innate musicality and musical ingenuity made it possible for him to work within the exigencies of the veristic philosophy and yet maintain an excellent balance between music and drama. Judged in the light of the

dramatic function which it serves, his music has considerable artistic worth. Unfortunately the majority of the verists had neither Puccini's musical craftsmanship nor his dramatic discrimination, and in the hands of the lesser verists verismo opera degenerated until it reached a state

of musical anarchy and tasteless theatricality. The death of the master verist, Puccini, marks both the decline of verismo and the end of a long line of Italian opera world successes.

Microfilm \$6.55; Xerox \$23.40. 516 pages.

PHARMACOLOGY

**QUANTITATIVE MEASUREMENT OF
THE EFFECTS OF TRANQUILIZING DRUGS
AND OTHER CENTRAL NERVOUS DEPRESSANTS
ON BETTA SPLENDENS**

(Order No. Mic 61-2599)

Steven Carson, Ph.D.
New York University, 1958

Adviser: Dr. Ross F. Nigrelli

A test has been developed and is described that measures quantitatively and qualitatively the effects of drugs on behavioral manifestations of the underlying cerebral processes concerned with tranquilization. This test has been applied to all of the different types of drugs used clinically and positive correlation of test results and the relative potency of these materials with known standards are reported.

Aggressiveness, an inherent behavioral trait, is manifested in the male Betta by an all or none biological response and is sensitive to the action of ataractic drugs. This furnishes a biologically titratable end point for the pharmacological evaluation of any class of materials. The alteration of this highly characterized complex of fighting responses offers a specific test for ataractic drugs and is capable of differentiating ataraxia from sedation.

The neuroanatomical and neurophysiological basis for the development of this test is described. The findings of these pharmacological experiments were used to extend the functional relationships of the teleost brain. These relationships are drawn from comparable results in mammalian species.

The applicability of the Betta fighting test for the differentiation of cholinergic, anticholinergic, and adrenergic blocking mechanisms in the induction of ataraxia is stressed. The wider applicability of this test is compared with the more specific tests involving a single pharmacological type of mediation. The rationale for this wider specificity was based on the lower degree of phylogenetic specialization in the teleost.

The role of 5-hydroxytryptophane in the synthesis of the biogenic amines of the teleost is described. The lack of serotonin in the teleost was due to the inability of the organism to hydroxylate tryptophane in the metabolic cycle. 5-hydroxytryptophane caused an inhibition of fight at dosages that would account for reserpine activity.

This test should be of interest and value in the pre-clinical and post clinical evaluation of new synthetic organic compounds.

Microfilm \$2.75; Xerox \$6.80. 141 pages.

**THE ACTIONS OF A GROUP OF
CENTRALLY ACTING MUSCLE RELAXANTS
ON THE RESPONSES TO LOW AND HIGH
FREQUENCY STIMULATION OF THE
MESENCEPHALIC RETICULAR FORMATION**

(Order No. Mic 61-1455)

Thomas Edward Lynes, Ph.D.
Emory University, 1959

Director: Harry L. Williams

The group of central nervous system depressants which are commonly called centrally acting skeletal muscle relaxants have not been adequately differentiated from the wider class of central nervous system depressants, termed hypnotics or sedatives.

The demonstration by King (1954) and Domino (1955) that mephenesin and pentobarbital have reciprocal effects upon the arousal response and the recruiting response, suggested that centrally acting skeletal muscle relaxants could be distinguished from other central nervous system depressants on the basis of their effects in such a system. In order that chronic experiments, as well as acute experiments, might be undertaken, it was felt that a preparation in which only one area of the brain stem was stimulated would simplify the procedures. O'Leary et al. (1958) have described a cortical recruiting response induced by stimulation of the rostral mesencephalic reticular formation in rabbits. Electrodes were implanted in this area in acute and chronic cat preparations. Stimulation at high frequency (300 c/s) resulted in typical EEG arousal, and in chronic preparations, behavioral arousal. Low frequency stimulation (8 c/s) produced a response, widely distributed over the cortex, of long latency, which showed temporal summation. This response has been identified with the recruiting response produced by low frequency stimulation of the diffuse thalamic projection system.

Mephenesin, meprobamate, zoxazolamine, styramate, chlormethazanone, and dichlormethazanone were compared with pentobarbital sodium and ethyl alcohol. In acute experiments, mephenesin, zoxazolamine and low doses of meprobamate (5 - 40 mgm./kgm.) increased the cortical recruiting threshold. Pentobarbital sodium, styramate, chlormethazanone and dichlormethazanone produced a decrease in recruitment threshold.

Reciprocal effects on the EEG arousal response were produced by the compounds studied. Mephenesin and zoxazolamine had little effect on the arousal response. Low doses of meprobamate (5 - 40 mgm./kgm.) produced a decrease in arousal threshold. Higher doses (70 - 100

mgm./kgm.) produced an increase in this threshold. Styramate, chlormethazanone, dichlormethazanone, and pentobarbital blocked the arousal response.

High frequency stimulation of the reticular formation, along with cortical arousal, generally produced a pressor response. The compounds studied had effects on this response which did not seem directly correlated to their effects on either the arousal or the recruiting response.

Mephenesin, zoxazolamine, styramate and pentobarbital, at low doses, depressed the reactivity of the vaso-motor response. Chlormethazanone and dichlormethazanone had little demonstrable effect on this reaction. Meprobamate at low doses produced an increased excitability of the pressor phenomenon. Higher doses depressed the reaction, but not proportionally with the depressant action on the arousal system.

In the chronic experiments, low frequency stimulation of the reticular formation produced no striking change in behavior. The response, in chronic experiments was of the same form, latency and distribution as the response in acute experiments. Electroencephalographic arousal was produced at lower threshold than was behavioral arousal.

Mephenesin increased behavioral arousal threshold at

doses which did not affect EEG arousal. Zoxazolamine caused a slight decrease in behavioral arousal threshold but had little effect on EEG activation. Pentobarbital and styramate increased both behavioral and EEG arousal thresholds. Meprobamate had a biphasic effect on behavioral arousal and EEG activation. Both responses were intensified at low doses. Behavioral arousal threshold was depressed at doses of meprobamate which had an excitatory effect on electrographic arousal.

A review of the effects of the centrally acting muscle relaxants analyzed in this study indicates that the effects of these compounds do not warrant their classification in a single group. Mephenesin and zoxazolamine are almost identical in their effects. Low doses of meprobamate resemble mephenesin, but the excitatory effect of these low doses of meprobamate indicate a fundamental difference in their effects on the nervous system. Chlormethazanone and dichlormethazanone seem like pentobarbital but may be more nearly like chlorpromazine or atropine. Styramate and pentobarbital are qualitatively similar in all respects. Ethanol and meprobamate seem to be closely related in action.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

PHILOSOPHY

THE NATURAL NUMBERS FROM FREGE TO HILBERT

(Order No. Mic 61-2655)

David Wells Bennett, Ph.D.
Columbia University, 1961

This dissertation describes contributions of Cantor, Dedekind, Frege, Russell, Poincaré, Brouwer, and Hilbert to the foundations of the arithmetic of the natural numbers. It spans the important half-century of foundations research dating approximately from the publication of Frege's *Begriffschrift*, in 1879, to the appearance--just when the work of Hilbert and his collaborators was at its peak--of Gödel's famous paper of 1931. Special consideration is further given to some ideas, due chiefly to Skolem, which have been developed since 1931; but no general survey of the more recent period is attempted.

The following is a complete list of chapter headings and sub-headings:

I. GEORG CANTOR

Historical Background--Cardinal Numbers--The Natural Numbers--Ordinal Numbers--The Transfinite

II. RICHARD DEDEKIND

Systems and Transformations--Chains--Mathematical Induction--Finite and Infinite Systems--The Natural Numbers--Greater and Less--The Number of Elements of a Finite System--Definition by Induction--Influence of Dedekind's Work

III. GOTTLÖB FREGE

Numbers Described as Abstractions from Classes or Aggregates--Numbers Described as Belonging with Concepts--Concepts Described as Functions--Frege's Theory of Number--Frege and Dedekind Compared--Summary

IV. BERTRAND RUSSELL

The Frege-Russell Definition of Number--Classes and Propositional Functions--Frege and Russell Contrasted--Realism, Logicism, and Psychologism

V. HENRI POINCARÉ

Mathematical Induction and the Synthetic A Priori--Poincaré and Intuitionism--Poincaré and Russell--Poincaré and Hilbert--Deriving the Finite from the Infinite--Non-Predicative Definitions and Classifications--Finitism and Constructivism

VI. L. E. J. BROUWER

Some Basic Doctrines--Existence and Construction--Classical Arithmetic and Intuitionist Arithmetic--The Kolmogoroff Interpretation--Constructivism and Psychologism

VII. DAVID HILBERT

The Formal Method--The Hilbert Proof Theory--Interpreting the Formalism--Consistency Proofs--Gödel's Results and the Decline of the Hilbert Program

VIII. FURTHER DEVELOPMENTS

The Decision Problem--Formal and Informal Axiom Systems and Their Models--Recursive Arithmetic

IX. SOME CONCLUSIONS

This list must suffice to suggest the nature of the topics considered in the dissertation; a more extensive summary of details cannot very well be undertaken here.

The final chapter summarizes material of the preceding chapters and states in a brief and dogmatic way some opinions of the author. This chapter is dominated by the somewhat neglected ideas of Skolem, who proposes a so-called Recursive Arithmetic as the appropriate foundation for the natural numbers. The legitimacy of this arithmetic is defended against some objections of Heyting, and its connection with the arithmetical system of the latter is briefly discussed. The author concludes, in agreement with Heyting and Brouwer, that finitary arithmetic is a desideratum, although the form of finitism advocated is that of Skolem's Recursive Arithmetic rather than that of Brouwer and Heyting. But transfinitary and even "Platonic" notions cannot be wholly rejected, it is admitted, unless we are willing to repudiate practically the whole of present day mathematics, including parts of ordinary arithmetic.

In a thirty-four page appendix the details of a technical formulation for Skolem's Recursive Arithmetic are given along lines developed by Hilbert and Bernays, Curry, and R. L. Goodstein. This appendix embodies a number of ideas original with the author.

Microfilm \$3.35; Xerox \$11.70. 257 pages.

INTERESTEDNESS AND NON-INTERESTEDNESS: TWO APPROACHES TO KNOWLEDGE.

(Order No. Mic 61-1073)

Jerome Eckstein, Ph.D.
Columbia University, 1961

The major point of this dissertation is to suggest that the distinction between interestedness and non-interestedness can prove to be fertile in investigating the nature, scope, and potentialities of different approaches to knowledge.

By "interestedness" and "non-interestedness" I refer to two different kinds of attitudes or states of mind, and by "interested knowledge" and "non-interested knowledge" I designate the knowledge which is gained respectively in the above states. "Interestedness" signifies a state of mind in which there is at least the usual waking-state concern and potentiality to manipulate the environment successfully in order to satisfy the practical needs for power and survival; and "non-interestedness" points to an attitude in which this potentiality and concern is exhibited to a lesser degree than is usual for the waking-state. However, I do not use "practical" or "manipulative" only in their narrow sense—as that which is directly feasible and effective for power and survival; I want to include in their meaning also that which is chiefly concerned with the gen-

eral, instrumental, or calculative aspects of a thing, event, or situation—and this need not be utilitarian. Nor do I mean by "non-interestedness" that the person is necessarily passive; rather, I wish to indicate that he is probably primarily concerned with the pervasive, permeating, and immediately experienced quality which gives unity to the whole situation or subject-matter.

The writings of Henri Bergson are investigated mainly to show that he believes that interestedness and non-interestedness (there are some differences in our conceptions of these terms, but they do not disturb my thesis) can provide unique but equally valid kinds of knowledge. He argues that interestedness is reflected in the influence which man's usual concern with the utilitarian has upon man's thought, natural language, and perception. Bergson stresses the role which the categories of language, because of their concern with controlling the environment, play in shaping man's thoughts and perceptions. Science, for him, is the most effective display of interested knowledge. Bergson, however, is best known for emphasizing how intuition, which requires a non-interested state, can penetrate to a core of reality which is inaccessible to the conventional and practical ways of knowing of the interested state.

Benjamin Lee Whorf's hypothesis of linguistic relativity is then examined to show how he extends Bergson's argument that language, in its informative function, is a tool of interested knowledge. Whorf agrees with Bergson that language hides a metaphysics, but his hypothesis adds that the various natural languages contain different conscious and unconscious metaphysical assumptions—and these lead to different ways of thinking about and perceiving reality. An important difference between these two is that Whorf maintains that it is possible to transcend the metaphysical and perceptual limitations of one's natural language by acquiring an intimate knowledge of the categories of other natural languages, whereas Bergson recommends the development of one's intuitional powers for this purpose.

Finally, Erich Fromm's writings are studied in order to reveal his thesis that non-interested knowledge is provided in the dream-state. Bergson's explication of the distinction between interestedness and non-interestedness is the basic cog in Fromm's theory of dreams, and he admits this. Fromm argues that, because the usual waking-state is one of interestedness, man's feelings, thoughts, logic, and concepts of space and time are so shaped as to facilitate the success of his controlling the environment. But, he insists, when man is in the non-interested state of dreams, his thoughts and feelings are subject to the categories of a radically different language—and this can provide him with non-interested knowledge, which would probably otherwise be difficult to obtain.

Microfilm \$2.75; Xerox \$8.80. 192 pages.

**THE PROBLEMS OF THE INFINITE AND
THE CONTINUUM IN SOME
MAJOR PHILOSOPHICAL SYSTEMS OF
THE ENLIGHTENMENT**

(Order No. Mic 61-2693)

Rolf Armin George, Ph.D.
Michigan State University, 1961

Major Professor: William J. Callaghan

The philosophers discussed in this dissertation are Leibniz, Berkeley, Bayle, Kant, and Bolzano. Its aim is to show that certain difficulties connected with infinite and continuous sets were recognized by these philosophers, and that their systems were, at least in part, designed in such a way that these difficulties did not arise in them. Notably the so-called Paradox of Galileo played a major role in this respect: Galileo had shown that a one-to-one correspondence can be established between integers and their squares, and Leibniz realized that it is a property of all infinite sets that they have subsets the members of which can be brought in such a biunivocal correspondence with the members of the original set. Up to Bolzano, this was held to contradict the "wholly reliable" Euclidean axiom that the whole is bigger than its part, and was used to prove that infinite sets are impossible. Berkeley, for one, was aware of precisely this problem when he developed a metaphysic in which infinite sets do not occur.

Leibniz' solution consisted in the following: He assumed that the number of monads constituting or "giving rise" to any given finite body is always larger than any finite number, but that it is not permissible to speak of these monads as forming a set. When we nevertheless speak of a given body as forming one thing, we are taking a liberty that is excusable in everyday discourse only for reasons of its pragmatic efficacy. Such statements cannot be tolerated in a language that endeavors an ultimately reliable description of the universe. For, if a given body were an infinite set of parts, then it would have contradictory properties, so Leibniz believed.

Kant asserted that a phenomenal object does not have an infinite number of parts already in it. Its being extended is the result of the form of outer sense. Hence it cannot be said that it has more parts than this sense distinguishes in it. However, an operative decomposition of such an object can be carried out, and a rule of reason guarantees that this decomposition has no final stage. But this is not the same as to say that the object is a set of infinitely many members, or a whole with infinitely many parts, and this distinction supposedly forestalls the arising of paradox.

Bolzano was the first to realize that the so-called Paradox of Galileo is no paradox at all, but simply describes a common property of all infinite sets.

As concerns the constitution of continua the problem was that neither the assumption that a continuum ultimately consists of unextended parts, nor that it consists of extended parts seemed defensible. Against the former case it was argued that unextended parts, no matter how many, cannot make a finite extension, against the latter that extended parts are not ultimate, but are further divisible. Bayle held that none of the logical alternatives are defensible, so that no one need bother to change whatever opinion he happens to have on the subject.

Berkeley argued that there is no extension in objects, but only extension as perceived, and a phenomenal object cannot be said to have parts smaller than a minimum sensibile. Hence, any continuous shape will consist of a finite number of smallest particles, and the difficulty disappears. Berkeley held this to be one of the most important consequences of the "immaterial hypothesis." Kant's solution has already been sketched in connection with the Paradox of Galileo.

Leibniz' position was that there is no actual continuum, but that any continuum is an "intellectual construct." It must be analyzed as a concept, i.e. into simpler concepts, not into smaller parts. A part of a given continuous entity is considered to be a more complicated construct than the whole of which it is a part, since it must be described by reference to that whole. Thus continua are said to be "prior" to their parts. Leibniz consequently held that the quest for the ultimate spatial parts of continua is pointless.

Bolzano declared that in a continuum every point has a neighbor within any distance, no matter how small. This definition, although ultimately unsatisfactory, proved to be of great help in discovering various important properties of continuous sets.

The purpose of this dissertation is not to sketch the evolution of thought on the subjects of infinite and continuous sets, but to show how the problems connected with them were no less important in the development of Enlightenment philosophy than the epistemological predicaments customarily discussed in histories of philosophy.

Microfilm \$2.95; Xerox \$10.35. 228 pages.

THEORIES OF AESTHETIC INSPIRATION

(Order No. Mic 61-2757)

Hilde Stern Hein, Ph.D.
University of Michigan, 1961

There is a long history of speculation concerning the origin of artistic creativity. It has frequently been maintained that the creative artist is "inspired." The present study investigates the meaning and implications of the proposition that the artist is inspired, and so seeks, indirectly, to illuminate the nature of creativity itself.

The procedure followed is that of a historical and analytic examination of various concepts of inspiration which have been held by philosophers, psychologists and practising artists. Based on these observations certain recurrent features associated with aesthetic creativity are noted and an approach to a synthetic definition of "inspiration" is suggested.

On the basis of a literal interpretation of the term "inspiration," one expects a being or force which breathes the creative idea or impulse into the artist. Chapter I deals with the most naive version of this thesis, the classical muse theory. Chapter II is concerned with a more sophisticated elaboration of this theory, best represented by Plato, maintaining that the artist is divinely inspired. The discussion omits theological descriptions, and is restricted to the transaction presumed to take place between man and the deity who influences his creativity from without.

In Chapter III a number of non-theistic, even mechanistic, interpretations of the thesis that artistic inspiration has an external source are considered.

In Chapter IV the "divine inspiration" thesis is reconsidered, but this time in terms of several theories which regard the deity (or some aspect of deity) as residing within the artist.

Chapter V deals with two theories, represented by Shelley and Plotinus, which treat the inspiring force as a cosmic spirit (*logos*) transmitted through the artist.

In Chapter VI a number of doctrines are examined all of which maintain that the artist's inspiration is to some degree linked with disease. There is disagreement as to the positive or negative nature of the link.

Chapter VII examines a view held by Schopenhauer and Bergson, denying the existence of an inspiring force which imposes itself upon the artist. Inspiration is held to be constituted by the artist's privileged awareness of the fundamental non-conceptual nature of reality. Chapter VIII considers a theory which emphasizes the artist's primitive psychic participation in the reality he perceives and his symbolic patterns of expression.

Chapter IX discusses extracts from a variety of psychoanalytic theories which treat inspiration as a phenomenon including a motivational and a "structural" aspect. It is maintained that the "inspired" artist uniformly exhibits characteristic configurations of these elements, and that inspiration may be reduced to these features of the artist's psychic make-up. The Xth chapter analyzes a theory which reduces inspiration exclusively to the "motivational" aspect of the artist's experience.

In conclusion some comparisons are made between the views previously discussed, and some reappraisals of traditional problems related to aesthetic inspiration are attempted. Among these are the artist's alleged activity or passivity in inspiration, his freedom to create and to choose his subject, the spontaneity of inspiration, and the extent to which the completed work may be called a "product of inspiration." The nature of communication between artist and audience and the value of inspiration to all concerned receive some attention.

It is finally suggested that the artist's inspiration lies in his unique attitude toward experience and his utilization of this attitude in the common problem of giving meaning to one's life.

Microfilm \$2.75; Xerox \$9.00. 199 pages.

MOTIVES AND INTENTIONS

(Order No. Mic 61-2768)

Brendan Edwin Alexander Liddell, Ph.D.
University of Michigan, 1961

The purpose of this study is three-fold: (1) to gain a broader understanding of the basic concepts involved in the terms and expressions concerning action, motives, and intentions; (2) to examine these concepts in various contexts in order to develop a fundamental definition of each term; (3) to interrelate these concepts in a precise structure, providing thereby a coherent, unequivocal language of action. Such a study is important in view of the constant use of these terms in a language of action, and in

particular since there is no basic agreement as to how such terms should be used.

Each chapter is devoted to a basic concept. The problems concerning the use of the term are raised, various contexts are examined, and finally, the fundamental meaning common to these usages is abstracted so as to constitute a "core" definition. Often this procedure involves some prescriptive definition, when the analytic procedure is not sufficient to reach such a basic common meaning.

Action is the sphere of the whole study. First, then, action is seen to be human activity performed consciously, willingly, and purposively. Having thus established the boundaries of the investigation, the study proceeds to the "why" of any action, i.e., those causes, desires, and reasons which give rise to an agent's performance. Such influences are seen to comprise two general classes: (1) those which influence the agent to seek some end (causal influences), and (2) those which are looked upon as the end or objective of the action (purposive influences). Causal influences are shown to be insufficient explanations for an action.

Purposes are further divided into those which are the objectives of the performance (referred to as the intention of the action), and those which are to be acquired by means of the object of the action. Motives, then, are not a part of the action itself, and hence are distinct from intentions. An intention, on the other hand, is a unique attitude on the part of an agent with respect to his own performance, which attitude constitutes the mere performance as an action.

Finally, these conclusions are applied to questions concerning responsibility, in which it is seen that an agent is strictly accountable only for his actions, and only indirectly (if at all) for his motives and intentions. Though an intention determines an action as the kind it is (and not merely as an event), and a motive designates that for which the agent acts, it is what the agent does (as "defined" by the intention) which is the determinant of his responsibility.

Microfilm \$3.15; Xerox \$11.05. 243 pages.

A DEFENSE OF THE VERIFIABILITY PRINCIPLE

(Order No. Mic 61-2603)

Marvin Zimmerman, Ph.D.
New York University, 1958

Adviser: Professor Paul Edwards

The aim of this thesis is to present a critical study of the verifiability principle of meaning. The method employed in achieving this objective involves two major steps. First is offered, an analysis of the most important formulations of the verifiability principle, found in the writings of Schlick, Carnap and Ayer, in order to arrive at an understanding of the meaning and implications of the principle. Second, an evaluation is presented of the major types of objections that have accumulated during the last twenty years or so, in order to determine whether or not the verifiability principle of meaning is tenable.

It turns out that, apart from certain minor differences, the advocates considered are in basic agreement concerning

the form, meaning and purpose of the principle. Thus, they generally agree that the principle involves the notion of 'verifiability in principle' (logical possibility), that the principle is an analytic statement and that it serves the purpose of eliminating 'metaphysical' and similar statements from the class of meaningful statements.

The major types of objections herein considered are:

- I That the verifiability principle unjustifiably rules out certain obviously meaningful statements as meaningless, e.g., statements about the 'past,' 'future,' 'immortality.'
- II That some of the formulations of the principle are too 'liberal' in that they allow as meaningful, statements which are presumably not meaningful.
- III That the principle cannot constitute a criterion of meaning since it already presupposes meaningfulness in its application.
- IV That the principle classifies metaphysical statements as meaningless and nonsensical, although this is not in accord with ordinary usage of these terms.

- V That proponents of the principle arbitrarily rule out the possibility of 'non-sensuous' experiences, e.g., claims to 'mystical' experiences.
- VI That the principle implies that statements about 'other people's minds' are either meaningless or require a purely 'behavioristic' interpretation.
- VII That proponents of the principle rule out terms 'analogously' predicated about God, although they allow this in other cases.
- VIII That the principle itself fails to meet its own requirements.
- IX That proponents of the principle commit the fallacy of 'begging the question.'

From an evaluation of these and other objections, it is concluded that they can be adequately met; that the verifiability principle is tenable if understood, as an analytic truth, reflecting what is meant by 'meaningful,' in its 'cognitive' sense.

Microfilm \$2.75; Xerox \$7.60. 165 pages.

PHYSICS

PHYSICS, GENERAL

DYNAMIC MECHANICAL PROPERTIES OF POLYMERIC LIQUIDS AND GELS

(Order No. 61-2942)

Meyer Harold Birnboim, Ph.D.
The University of Wisconsin, 1961

Supervisors: Professors W. W. Beeman and
John D. Ferry

Experimental results have been obtained for the dynamic mechanical properties, namely the storage and loss components of the rigidity modulus in sinusoidal deformation and their related functions, of dilute polymeric viscoelastic solutions in both the liquid and the gel states. Two major objectives were: (1) to obtain such data over a sufficiently large range of frequency and of temperature so as to provide experimental data for testing of molecular theories for the dispersion of mechanical response of dilute polymer solutions such as those of Rouse and Zimm, and (2) to study the phenomenon of gelation in dilute polymeric solutions by observing the kinetic behavior of the dynamic mechanical properties as the solution progresses at a constant temperature from a liquid to a gel state. A new apparatus was constructed which permits measurement of both components of the complex modulus as small as 20 dynes/cm² over the frequency range from 0.01 to 400 cycles per second, and the temperature range from -40°C to 150°C. The coaxial cylinder sample cell with closed bottom, and with co-linear oscillation of the inner cylinder,

can contain both liquid and gel samples, and is similar in geometry to that of Smith, Ferry and Schremp. Two methods of determining the mechanical impedance of the system are employed to cover the extended frequency range; the phase meter mode for the lower frequency range compares the current through the electromagnetic drive with the displacement voltage from a linear variable differential transformer, while for higher frequencies in the impedance mode it is only the clamped and unclamped electrical impedance of the driving coil that need be determined. The systems studied were 2.3% and 3.0% di-2-ethyl hexyl phthalate solutions of a fractionated polyvinyl chloride which contained 2.5% vinyl acetate as a copolymer. The viscosity-average molecular weight was 100,000. These solutions were quenched from the melt at 160°C to various low annealing temperatures and the viscoelastic spectrum from 0.01 to 400 cycles per second was determined at various times as the system progressed isothermally from a liquid to a gel state. The results presented in terms of the frequency dependence of the various dynamic mechanical functions are representative of the liquid, intermediate, and gel states. Other thermal conditioning of the samples was also employed, and the results are presented in a similar manner. Some qualitative observations pertinent to the major objectives are: (a) For the relaxation spectra, H, calculated for several solutions both in the liquid and gel states, the slopes of the logarithm of H as a function of the logarithm of the relaxation time, τ, were often found to be -2/3 for about four decades, in agreement with Zimm's theory. (b) A low frequency equilibrium storage modulus, G_e, representing the network rigidity was found to distinguish a gel from a liquid state, although no such

clear distinction was apparent in the loss modulus. Curves for the isothermal kinetic growth of G_e for the various systems are presented. (c) The modulus, G_e , was not proportional to temperature as predicted by the kinetic theory of rubberlike elasticity. A temperature reversible change in size or number of crystallites is indicated.

(d) Using the values of the temperature shift factor, a_T , as obtained from steady state viscosity measurements on the solvent, it appears that the Ferry temperature-frequency reduction scheme is applicable to the liquid state, and may be applicable to the gel state if the contribution of G_e is subtracted off. (e) Evidence for possible existence of a second plateau in the rigidity modulus of the order of 10^4 to 10^5 dynes/cm² is cited.

Microfilm \$2.75; Xerox \$9.45. 207 pages.

SOME EFFECTS OF PROGRESSIVE
ULTRASONIC WAVES ON LIGHT BEAMS
OF ARBITRARY WIDTH

(Order No. Mic 61-2696)

Logan E. Hargrove, Jr., Ph.D.
Michigan State University, 1961

Major Professor: E. A. Hiedemann

If light is passed through a plane progressive ultrasonic wave normal to the direction of sound propagation, various diffraction phenomena may be observed. Except for a scale factor which depends on the ultrasonic frequency and the medium, the observed diffraction effects, in a limited but useful range, depend in a theoretically predicted manner only on the ultrasonic waveform (pressure amplitude and harmonic structure), the ratio of light beam width to ultrasonic wavelength, and the sound field configuration. This study attempts to experimentally verify certain predictions of the existing theories which have not previously received sufficient examination.

Quantitative experimental verifications of the theory developed by Zankel (1) were obtained at 1.0 mc in water for sinusoidal ultrasonic waves and narrow light beams. This theory was also confirmed for distorted finite amplitude ultrasonic waves and wide and narrow light beams at 3.0 mc in water. Some qualitative features of the dependence of diffraction on the relative phase between two adjacent ultrasonic waves of frequency 3.0 and 6.0 mc in water were experimentally shown to be correctly given by the theory of Rao (2), Murty (3), and Mertens (4) for simultaneous diffraction and by the theory of Mertens (5) for successive diffraction. Simultaneous and successive diffraction are indistinguishable in a limited range. Quantitative measurements showed that the successive diffraction theory of Mertens must be applied in the range of experimental parameters investigated.

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MEASUREMENT OF THE WIDTHS OF
MICROWAVE SPECTRAL LINES

(Order No. 61-2908)

Edgar A. Rinehart, Ph.D.
The University of Oklahoma, 1961

Major Professor: Chun C. Lin

The instrumental effects which may produce spurious broadening of measured line widths have been examined. These are found predominately to be amplitude, frequency, and wave form of source modulation; effect of klystron power level; non-linearities in the detection system; klystron mode curvature; and non-systematic effects. A microwave spectrograph designed and constructed to measure microwave line widths is described, considering the above effects. Methods of eliminating or compensating the instrumental broadening are described.

Correction formulas for the modulation broadening have been experimentally verified. It is found that square-wave source modulation yields more accurate data than does sine wave modulation. It is found further that detection of the second and third harmonics of the modulation frequency, when sine wave modulation is used, produces the second and third derivatives of the line shape. Since the instrument responds to the first and higher derivatives of the line shape, the sensitivity is found to improve at lower pressure. It is suggested that this effect, combined with detection of the second derivative of the line shape, may provide a valuable technique for improved resolution. Three methods of eliminating or compensating for the background curvature are discussed. Two of these are found to be suitable for strong lines, and the third, a triple-modulation scheme, is suitable for weaker lines.

The line width parameters of six lines of the ammonia inversion spectrum have been measured. Three of these differ mainly in precision from the previously reported measurements, while the others have not been previously reported. The measured line width parameters of the J=K series show deviation from the results of both the Anderson theory and the Bleaney and Penrose theory. Both of these theories take into account the dipole-dipole interaction, and the Anderson theory includes rotational resonance. It is suggested that the deviation of calculated values from the measured values is due to the interaction of the higher electric multipoles of the ammonia molecules.

Microfilm \$2.75; Xerox \$6.00. 124 pages.

THE SCATTERING OF ELECTROMAGNETIC WAVES BY A METALLIC STRIP AND ITS APPLICATION TO THE DIFFRACTION PATTERN OF THE ECHELETTE GRATING

(Order No. Mic 61-2625)

Leon N. Zadoff, Ph.D.
New York University, 1958

Adviser: Robert D. Hatcher

An exact solution has been obtained for scattering of plane electromagnetic waves of arbitrary polarization and arbitrary angle of incidence on an infinitely long metal strip. Previously, exact results had been obtained only for the special case of incidence in a plane normal to the axis. The exact results for arbitrary incidence, obtained here, reduce to the prior results for the special case of incidence normal to the axis. For the case of incidence normal to the axis, solutions have also been obtained for finite conductivity. The far-field solutions are then applied in obtaining the relative intensity of the spectral orders of the echelle grating. A comparison is made with an experiment involving radiation in the microwave region incident upon an echelle grating of an aluminum alloy. For the incident magnetic vector polarized parallel to the grooves of the grating excellent agreement with theoretical calculations result, however, for the incident electric vector polarized parallel to the grating grooves deviations occur. The deviations are discussed in terms of multiple scattering interactions between grating elements. The conditions under which the interactions may be neglected are specified in terms of the single strip diffraction pattern.

Microfilm \$3.25; Xerox \$11.25. 250 pages.

PHYSICS, ELECTRONICS AND ELECTRICITY

TOWNSEND IONIZATION COEFFICIENTS AND UNIFORM FIELD BREAKDOWN IN ARGON

(Order No. Mic 61-2645)

David Edward Golden, Ph.D.
New York University, 1961

Adviser: Leon H. Fisher

By studying pre-breakdown currents in uniform dc electric fields, simultaneous measurements have been made of the Townsend ionization coefficients α/p_0 and γ in argon as a function of E/p_0 , from an E/p_0 of 5 to an E/p_0 of 12, where p_0 is the gas pressure in mm Hg. reduced to 0°C and E is the electric field strength in v/cm.

The first Townsend coefficient α/p_0 has been found to increase in the range of E/p_0 from 9 to 12 in good agreement with the results of previous measurements. However, below an E/p_0 of 9 large deviations from the previous values of α/p_0 have been found. The present measure-

ments yield values of α/p_0 which are lower than the previous values of α/p_0 by as much as a factor of 15 at an E/p_0 of 5.

The second Townsend coefficient γ has been found to increase sharply with decreasing E/p_0 in the range of E/p_0 from 5 to 12. γ increases from about 10^{-2} at an E/p_0 of 12 to about 20 at an E/p_0 of 5. The variation of γ with E/p_0 is discussed. Secondary emission at low E/p_0 is attributed to the action of photons and metastable atoms, and secondary emission at high E/p_0 is attributed to the action of positive ions.

The dependence of α/p_0 and γ on the electrode separation d has been studied at constant E/p_0 . α/p_0 has been found to increase linearly with d . γ has been found to decrease exponentially with d for low values of d , but slightly slower for high values of d .

It has also been observed that the sparking voltage at a constant value of $p_0 d$ increases with increasing d in argon in violation of Paschen's law. No such violation of Paschen's law in hydrogen has been observed. The similarity laws are investigated in an attempt to explain these results.

The sparking voltage in argon at constant $p_0 d$ has been observed to increase by as much as a factor of 4 over a period of several days. The rate of increase of the sparking voltage has been found to depend on the magnitude of the current in the gas. The more current that is drawn from the gas, the faster the sparking voltage rises in time. This effect is also observed in hydrogen, but in hydrogen the magnitude of the effect is only about 0.5% of the final value of the sparking voltage. The raising of the sparking voltage in argon is attributed to the increase in the work function of the surface of the cathode due to the absorption of argon ions. In hydrogen, the process of gas coating of the cathode must occur much more rapidly than in argon. In hydrogen γ is small, so that the breakdown voltage is largely dependent on α/p_0 . Hence, small percentage changes in γ produce small changes in the sparking voltage. On the other hand, in argon γ is large. Therefore, small percentage changes in γ produce large changes in the sparking voltage.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

EXPERIMENTAL MEASUREMENTS
OF 1/f NOISE IN
GERMANIUM FILAMENTS

(Order No. Mic 61-1026)

Peter Owen Lauritzen, Ph.D.
Stanford University, 1961

Measurements were conducted on 1/f noise in germanium filaments with the intent of checking some previously proposed theories and of isolating, by a continuous series of experiments, some of the characteristics of the noise. The original approach was to determine the effect of intentional surface doping on the 1/f noise magnitude. It later appeared that some of the noise was coming from a source other than the surface, and further experiments were directed at isolating and examining the properties of the different types of noise. The experiments included measurements of the frequency spectrum, noise correlation,

temperature dependence, sensitivity to current level, and effects of a magnetic field.

When the surface was doped so as to create an inversion layer, the magnitude of the noise increased by 10 to 20 db, while creating a surface accumulation layer would decrease the noise 5 to 10 db. The noise from the inversion layer increases rapidly as the temperature decreases down to 200° K, and then remains approximately constant at lower temperatures. The noise magnitude associated with the accumulation layer is approximately constant at low temperatures and then it rises in the near-intrinsic range. All types of 1/f noise disappear when the semiconductor becomes intrinsic.

Surface 1/f noise depends upon the existence of an inversion layer at the surface. A model is presented which considers the possibility of noise generated in high field regions created by surface inclusions.

Another type of noise can appear when the semiconductor is nearly intrinsic. Noise fluctuations then can be carried down the filament from the current-carrying contacts or noisy spots on the surface by drift of minority carriers. This noise is correlated with noise generated at the contacts and with noise appearing at other regions along the surface. It is very temperature sensitive, reaching a high-magnitude peak in the near-intrinsic region, and it also exhibits a very non-linear dependence of the noise magnitude upon the bias current level. An expression is derived which correctly describes this non-linear current dependence of the noise. This type of noise appears to have been previously measured as surface noise by some experimenters.

Only the noise associated with the accumulation layer can fit the existing theories, and it is of very low magnitude compared with the other types of noise. The experiments demonstrate directly an application to making a low-noise Hall bridge by creating a surface accumulation layer on the bridge. They also indicate a possibility of making low 1/f noise diodes and transistors.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

PHYSICS, METEOROLOGY

THE GULF STREAM AS AN EQUIVALENT-BAROTROPIC SYSTEM

(Order No. Mic 61-2627)

Donald Paul Martineau, Ph.D.
New York University, 1958

Adviser: Dr. Gerhard Neumann

The equivalent-barotropy of the Gulf Stream is investigated following the method suggested by Neumann. The cross-stream, seasonal, and downstream variations are discussed from the results of the analysis of selected sets of hydrographic sections across the current.

The surface velocities and depth of the lower boundary for an equivalent-barotropic Gulf Stream are determined to be similar to values observed by GEK, LORAN-DR, and bathypitotmeter measurements; but the surface velocities are found not to represent the means of the layers

comprising the current as required for an equivalent-barotropic system. The maximum velocity and the average velocity of the easterly flowing water appear to be greatest in winter and spring and agree with other results based on mean monthly surface current data.

The results show the equivalent-barotropic Gulf Stream is deepest and densest in winter and shallowest and lightest in summer. Some reasons for this variation are suggested.

The downstream variations in the dynamic and geometric properties of the equivalent-barotropic Gulf Stream are determined to be less pronounced than are the cross-stream and seasonal ones.

Microfilm \$2.75; Xerox \$4.80. 92 pages.

PHYSICS, NUCLEAR

β - γ CIRCULAR POLARIZATION CORRELATION OF Sb¹²⁴*

(Order No. Mic 61-2454)

Peter Alexander, Ph.D.
Purdue University, 1961

The angular distribution of the circularly polarized 603 kev γ radiation following the 2.31 Mev β -transition of Sb¹²⁴ ($3^- - 2^+ - 0^+$ cascade) has been measured. The degree of circular polarization P_c was determined for seven angles θ between 90° and 180° using very narrow γ acceptance apertures in the polarization analyzer magnet. $P_c(\theta)$ was found to be positive over this angular interval in contrast to the results of Hartwig and Schopper¹ who reported a change of sign of $P_c(\theta)$ between $\theta = 90^\circ$ and $\theta = 180^\circ$. From the measured circular polarization correlation and the β - γ directional correlation² the nuclear matrix elements contributing to the first forbidden 2.31 Mev β -transition of Sb¹²⁴ may be determined. Using Kotani's³ notation ($z = 1$) we find $Y = 0.60 \pm 0.15$, $|u| = .01 \pm .01$, $|x| = 0.07 \pm 0.09$. A more accurate evaluation of the β - γ correlation results by means of an electronic computer is in progress.

*Work supported by the U. S. Atomic Energy Commission.

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3. T. Kotani, Phys. Rev. 114, (1959).

Microfilm \$2.75; Xerox \$8.20. 177 pages.

**ELECTRON-ELECTRON SCATTERING
AT 500 MEV**

(Order No. Mic 61-1017)

Edgar Brandon Dally, Ph.D.
Stanford University, 1961

The electron-electron differential scattering cross section has been measured with the use of a 500 Mev electron beam from the Stanford University Mark III linear electron accelerator. Deviations were sought from the theoretical cross section as calculated in first order perturbation theory (Møller scattering). The experimental results were compared with the Møller theory as corrected to third order in perturbation theory. These corrections have been calculated by Tsai. The result of the measurement depends explicitly on the validity to one percent of the theoretical elastic-nuclear scattering cross section (Mott scattering) as corrected for radiative effects.

Atomic electrons in a beryllium target foil constituted the target source for the electron-electron scattering. The scattered electrons passed through a slit system which defined the angle of scattering and the solid angle. After the particles passed through the slit system, they entered a double-focussing magnetic spectrometer, which analyzed the scattered particles in momentum. Because of the kinematic behavior in electron-electron scattering, the laboratory angles of scattering are very small. In order to collect the electrons at small angles and not to interfere with the incident accelerator beam, it was necessary to use a magnet of C-type yoke design. After the electrons left the spectrometer, they were detected with the use of a liquid Čerenkov counter. The incident beam was monitored with the use of a Faraday cup and an electronic current integrator.

In order to enhance the accuracy of the experiment, the experimental electron-electron scattering was compared to the Mott scattering from the target nuclei. The Mott scattering was performed at an incident energy which corresponded to the final energy of the electron-electron scattering for one angle (4 1/2 degrees). The electron-electron scattering from other angles was also compared to the Mott scattering at the 4 1/2 degree point.

The cross section at each angle was measured several times. The statistical error was approximately 3% for each measurement after the subtraction of background and the formation of the ratio of the electron-electron to the Mott scattering. The total systematic error was approximately 2 1/2%. The largest single systematic error occurred in the determination of the angle of Mott scattering.

A χ^2 test was applied to the data. The data were tested for a fit to the Møller theory and to the Møller theory corrected for radiative effects. The results agreed with the corrected theory and showed that the Møller theory must be corrected. When the results were shifted upward by the 2 1/2% estimated systematic bias, the Møller theory and the corrected Møller theory had an approximately equal probability for validity. A shift of the results downward by 2 1/2% rejected the Møller theory and agreed with the corrected theory.

The theoretical radiative corrections for each measured point, expressed as a percentage deviation from the Møller theory, are -5.5, -4.9, and -4.9 percent for the scattering angles 2.6, 3 1/2, and 4 1/2 degrees, respectively. The average values of the deviations from Møller

scattering which were measured in this experiment at the above angles are -3.3, -3.6, and 6.2 percent, respectively. Each of the above measured points has approximately a $\pm 2\%$ total statistical error.

The results of this experiment agree with the calculation of Tsai within the experimental error. No anomalous behavior of quantum electrodynamics is observed in this experiment. Microfilm \$2.75; Xerox \$5.60. 113 pages.

**THE ADIABATIC HYPOTHESIS IN
PSEUDOSCALAR AND PSEUDOVECTOR
COUPLED MESON THEORIES**

(Order No. Mic 60-2601)

Joseph Martin Geiger, Ph.D.
Syracuse University, 1960

The validity of the adiabatic decoupling hypothesis is examined for pseudoscalar and pseudovector type couplings of the meson-nucleon fields. The Schwinger formulation of field quantization is employed to generate the equations of motion, the mass and polarization operators, and the Green's functions for the two types of pseudovector coupling. Mass shifts are calculated for the nucleon and the meson using second order perturbation theory. These are compared to the mass shifts obtained using the mass and polarization operators on the energy shell and invoking the adiabatic hypothesis. S matrix elements are calculated for meson-nucleon and nucleon-nucleon scattering using time dependent perturbation theory and the correct scattering states. These states are obtained for certain simplified theories (no nucleon-antinucleon pairs) using second order perturbation theory. The same S matrix elements are also calculated using the relation that the S matrix elements of a particular problem are the Fourier amplitudes of the Green's function describing that problem. This relation requires the use of the adiabatic hypothesis. To second order in the coupling constant the mass shift calculations and the S matrix element calculations for pseudoscalar type theories agree, indicating the correctness of the adiabatic hypothesis in this case. For pseudovector type couplings, neither the nucleon mass shift calculations nor the nucleon-nucleon scattering calculations agree to order g^2 . Disagreement is also anticipated in the meson mass and in meson-nucleon scattering in fourth order. The adiabatic hypothesis is thus incorrectly stated for derivative type couplings. A second consequence of the calculations is the possibility of distinguishing between pseudoscalar and pseudovector couplings to order g^2 in nucleon-nucleon scattering. Unfortunately, the difference is a contact term. It thus effects the core rather than the tail of the nuclear potential. As a result it is very difficult to verify experimentally.

Microfilm \$2.75; Xerox \$5.20. 101 pages.

**v/c DEPENDENCE OF BETA-GAMMA
(CIRCULARLY POLARIZED)
CORRELATION IN Co⁶⁰**

(Order No. Mic 61-1079)

Yung-Keun Lee, Ph.D.
Columbia University, 1961

The v/c dependence of the beta-gamma (circularly polarized) correlation in Co⁶⁰ was studied with a magnetic lens spectrometer set at 4% transmission and 6% resolution. A forward scattering cylindrical magnet was used as the circular polarization analyzer. About 250 μ c of Co⁶⁰ (190 μ g/cm² thick) was deposited on a 20 μ g/cm² formvar film and covered by a 10 μ g/cm² collodion film. The Kurie plot of the beta-spectrum which was taken in coincidence with the high energy end (350 kev to 630 kev) of the scattered gamma-spectrum exhibited linearity from the upper energy end down to about 60 kev, below which it slightly deviated downwards, implying that electron scattering in the source or the spectrometer is negligible. The circular polarization of gamma rays was measured in coincidence with beta-particles at the following three electron energies: 42 kev ($v/c = 0.40$), 122 kev ($v/c = 0.60$), and 227 kev ($v/c = 0.72$). The linearity of the degree of polarization of gamma-rays as a function of v/c of the electron is excellent. These results indicate that the circular polarization of gamma rays in a beta-gamma cascade is directly proportional to the momentum of the preceding beta-particle in accordance with the two component neutrino theory.

Microfilm \$2.75; Xerox \$4.60. 86 pages.

THEORY OF (d,p) REACTIONS.

(Order No. Mic 61-2771)

Cecil Robert Lubitz, Ph.D.
University of Michigan, 1961

The differential cross section for the deuteron stripping reaction to a particular state in the residual nucleus (target plus captured neutron) is evaluated subject to the following approximations:

1. The interaction between the outgoing proton and the residual nucleus is divided into a central, non-spin-dependent potential V_{np} between the proton and the neutron in the incident deuteron, plus an optical potential V_{tp} between the proton and the target nucleus. Both potentials are treated as source terms in the transition matrix element.

2. The exact wave function is approximated by a modified plane (incident) wave. The modification consists of phenomenological cutoff functions which decrease the amplitude of the wave when either the neutron or the proton approaches the nucleus. This attenuation represents absorption in the sense of the optical model.

Compared to the Butler theory, the present work involves three principal differences:

1. If the Butler cutoff is regarded as absorption of the incident wave then additional proton-induced absorption has been added.

2. The radius at which the incident wave falls to half

its asymptotic intensity (the cutoff radius) is regarded as an adjustable parameter, essentially independent of the nuclear radius.

3. The interaction between the proton and the target nucleus is taken into account. Because it is treated as a source term in the matrix element, and scattering or refraction of the incident wave is neglected, the complexity of the distorted wave treatment is avoided.

As a result of the above three points, certain features of the stripping reaction seem more physically reasonable than hitherto:

1. By allowing the cutoff radius to vary with energy, the angular distribution can in principle be fitted with an energy-independent nuclear radius and reduced width. (On the other hand, when the Butler radius is chosen to fit a particular stripping peak at different energies, its value generally varies, so that it is effectively energy-dependent, and causes a similar energy-dependence of the reduced width.)

2. By divorcing the nuclear radius from the larger cutoff radii, the former's value is reduced from that required by the Butler theory. A second factor tending in the same direction is the removal of the inner proton region by the additional cutoff. In the Butler theory, this region pushes the stripping peak to large angles, and bringing it forward requires a fictitious enhancement of the neutron cutoff radius.

3. The proton cutoff reduces the single-particle cross section by an order-of-magnitude, with a corresponding increase of the reduced width relative to the Butler theory value. Because the modified matrix element is roughly proportional to Butler's, the reduced width ratios are not drastically affected.

4. Quantitatively reasonable results are obtained by including as a source term an optical potential interaction between the target nucleus and the stripped proton. A similar procedure in the Butler theory leads to incorrect results, because the proton "overlaps" too strongly with this potential. The imaginary part of the potential produces qualitatively new results, eliminating the nodes in the Butler angular distribution, and causing a polarization of the outgoing proton. Of special interest is the prediction of a correlation between the capture j-value and the sign of the polarization, the latter being in agreement with experiment.

The same formalism is applied to the deuteron elastic scattering reaction, and it is shown how a (d,d) analysis can in principle determine the cutoff radii, so that the (d,p) parameters are essentially specified in advance. The practical application of this procedure is however hampered by a lack of uniqueness in the shapes of the cutoff functions and in the absorptive potential representing deuteron dissociation. [The proton-nucleus potential, itself not unique, is supposed for simplicity to be determined by the (p,p) reaction].

Microfilm \$2.75; Xerox \$6.40. 131 pages.

- I. THE SEPARATION OF HIGH-ENERGY
PARTICLE BEAMS BY MICROWAVE TECHNIQUES.
II. A PROPOSED EXPERIMENT TO MEASURE
THE MASS OF THE π MESON.
III. TWO CONJECTURES ABOUT THE ORIGIN
OF THE BARYON FAMILY.
IV. REFLECTION PROPERTIES OF
SPINORS AND THE ORIGIN OF FERMIONS
WITH NON-ZERO REST MASS.

(Order No. Mic 61-1035)

Peter Roderick Phillips, Ph.D.
Stanford University, 1961

If a charged particle passes through a microwave cavity excited in a suitable mode it will in general be slightly deflected, the magnitude and sense of the deflection depending on the entry phase. We can use this effect to time particles over a known flight path, the resolving time being a fraction of one cycle of rf. This is of great interest because time-of-flight methods are extensively used to separate beams of high-energy particles. The technique is especially suited for use with the electron linear accelerator at Stanford, which runs at 2856 Mc/s. This implies a timing accuracy of less than 10^{-10} sec.

In Part I we describe the method in detail, including the design and construction of a cavity resonant in the TM_{012} mode and capable of dissipating 1 Mw peak power. Our experimental results agree with theoretical predictions. The technique seems to be best adapted to use with future accelerators giving very high-energy electron beams.

In Part II we analyze a proposed experiment to measure the mass of the π meson. The mesons are to be sent through the microwave cavity described in Part I, and their time of flight between target and cavity determined from their deflection. By comparing this time to that of protons of the same momentum over the same flight path we can find the ratio of the masses of π mesons and protons. The experiment seems to be feasible but very difficult in its details.

Parts III and IV are purely theoretical. In Part III we investigate the possibility of putting the members of the baryon family in correspondence with the four independent wave equations for 8-component spinors. While some interesting things can be said no new fundamental point of view emerges, in particular the meaning of the strangeness number remains obscure. In Part IV we examine the possibility of associating the mass-reversal transformation with the usual transformations $\mathcal{P}, \mathcal{T}, \mathcal{C}$, for spinor fields. This leads us to associate the fermions with non-zero rest mass with spinor fields which transform in different ways under these reflections. While the meaning of strangeness becomes clearer the scheme has difficulties of its own, the chief ones being the exclusion of the neutrino field and the necessity of having K-meson interactions which do not conserve parity.

Microfilm \$2.75; Xerox \$8.00. 174 pages.

PARAMAGNETIC RESONANCE ABSORPTION
AND NUCLEAR SPIN HYPERFINE STRUCTURE
STUDIES IN THE MICROWAVE REGION

(Order No. Mic 61-2620)

Max Michael Weiss, Ph.D.
New York University, 1958

Adviser: Professor Y. Beers

A one centimeter paramagnetic Resonance Spectrometer was assembled to study the hyperfine spectra of several isotopes in order to measure their nuclear spins and where possible their magnetic moments. The system includes facilities to stabilize the microwave klystron oscillator frequency to either a frequency standard or the resonant frequency of a cavity. In addition a magnet current stabilization system is incorporated into the system which makes available facilities for slowly sweeping the magnetic field reasonably linearly over a range of about 1000 gauss in the neighborhood of 8600 gauss.

Nickel⁶¹ was studied using single crystals of nickel fluosilicate as the vehicle. No hyperfine structure was observed in this isotope. However, the fine structure spectrum variations were obtained as a function of orientation.

Phosphorous³² was studied in neutron activated KCl by means of the (n,α) reaction on Cl³⁵ and in neutron activated sulphur by means of the (n,p) reaction on S³². No paramagnetic resonance spectrum attributable to P³² was obtained.

Vanadium⁴⁹ was studied in a xylene solution of vanadium (IV) - cupferron chelate prepared from a sample of titanium by means of a (d, n) reaction on Ti⁴⁸. The ratio of V⁴⁹ to V⁵¹ in the resulting sample was of the order of one part in 200. The hyperfine pattern obtained for the vanadium sample showed two very weak components consistent with the magnetic quantum number assignments of +5/2 and +7/2 respectively. The lower m components could not be resolved from the V⁵¹ lines. If a 9/2 component had been present it would have been visible. These results are consistent with a V⁴⁹ spin assignment of 7/2 and a magnetic moment ratio of μ^{49}/μ^{51} of 0.867 ± 0.01 .

Microfilm \$2.75; Xerox \$5.40. 110 pages.

PHYSICS, SOLID STATE

SUPERCOOLING OF WATER
IN GLASS CAPILLARIES

(Order No. Mic 61-2447)

Ramlal Singh Chahal, Ph.D.
Cornell University, 1961

Hosler and Hosler (1955) demonstrated that the temperature to which water could be supercooled in glass capillaries was dependent on the bore diameter alone. These results were in disagreement with those of Bigg (1953), who found that freezing temperatures of water drops suspended between two immiscible liquids were

closely related to drop volume. Mossop (1955), found a similar relationship for water frozen in glass tubes which were hydrophobically treated. He was led to believe that Hosler and Hosler's results were caused by contamination of the glass surface.

In this investigation double distilled water was frozen in glass capillaries with bore diameter in the range 0.5 to 6 mm. Capillaries were cleaned with hot chromic acid and alcoholic alkali. When a length of a capillary was partially filled and the entire length of the specimen was exposed to low temperatures, results resembling those of Hosler and Hosler's were obtained. In general greater supercooling with smaller standard errors was obtained in the case of larger tubes. Observations with individual tubes indicated that the length of the water column had no effect on the freezing temperature. Samples which were allowed to stand for different lengths of time before freezing gave slightly lower and more reproducible freezing temperatures. A straight line relationship was obtained between the freezing temperatures and log (diameter of the tubes).

When a longer length of the tube was filled, and a short length of it with no air-water interface was cooled; much greater supercooling could be obtained. These results could be related to the volume of the specimen, or to the area of the glass-water interface in the freezing zone. Results obtained by varying the length of the freezing zone in capillaries of various sizes suggest that under the experimental conditions, area of glass-water interface might be more important than volume of a specimen.

When a series of bubbles alternating with plugs of water were present in the freezing zone, slightly higher but not significantly different freezing temperatures were obtained than for a single short column. Greater scatter was observed in individual observations when more than one bubble was present in the chilled zone. Thus the presence or absence of the air-water interface in the freezing zone determined whether the results were related to: (1) the capillary diameter alone, or, (2) to the volume or surface area of the samples. This experiment also suggests that the controlling factor is neither atmospheric contamination nor the area of the air-water interface, for both would have reduced the supercooling found with multiple interfaces. Thus one is led to suspect that curvature of the air-water interface is closely connected to initiation of freezing.

Microfilm \$2.75; Xerox \$3.00. 42 pages.

PULSED NUCLEAR MAGNETIC RESONANCE IN ALKALI HALIDES

(Order No. Mic 61-2443)

William Gilbert Clark, Ph.D.
Cornell University, 1961

Free induction decay shape, quadrupolar echo shape, and spin-lattice relaxation time (T_1) measurements have been made on single crystals for Br^{79} and Br^{81} in KBr, I^{127} in KI, and Na^{23} and I^{127} in NaI:Tl. The measurements were performed over a temperature range from 77°K to near the melting point of each substance. The T_1 measurements for these substances can be broken into two categories: (a) a temperature range (below 550°K for NaI:Tl and KBr, below 900°K for KI) which, except for Na^{23} at

77°K, yields T_1 measurements intrinsic to the material and whose temperature dependence is in substantial agreement with that predicted by the Van Kranendonk two phonon process and (b) a high temperature range where T_1 measurements can depend on the particular sample used, and the dominant T_1 mechanism is diffusion motional relaxation via quadrupolar coupling. At 300°K, T_1 for I^{127} in KI is $.0156 \pm .0005$ sec., for I^{127} in NaI:Tl is $.0102 \pm .0003$ sec., for Na^{23} in NaI:Tl is $8.46 \pm .43$ sec., for Br^{79} in KBr is $.0725 \pm .0025$ sec., and for Br^{81} in KBr is $.104 \pm .003$ sec. Above 175°K, measurements in the temperature range for intrinsic values of T_1 are fitted by a power law dependence on the absolute temperature. This temperature dependence is $T^{1.85 \pm .07}$ for I^{127} in KI, $T^{1.91 \pm .08}$ for Br^{79} and Br^{81} in KBr, $T^{1.84 \pm .07}$ for I^{127} in NaI:Tl, and $T^{1.78 \pm .13}$ for Na^{23} in NaI:Tl. No evidence for the Khutishvili four phonon T_1 mechanism is observed. In KBr free induction decay and quadrupolar echo shapes showing the dependence of quadrupolar broadening on the orientation of the crystal relative to the external magnetic field H_0 have been measured. In all substances studied, quadrupolar broadening disappears at high temperatures. The disappearance is interpreted as arising from the annealing of dislocations, which reappear when the crystal is cooled to room temperature. At temperatures on the order of 600°K diffusion increases the free induction decay lifetimes; at still higher temperatures, free induction decay lifetimes decrease. This decrease is tentatively ascribed to quadrupolar broadening by vacancies. Calculations of the effects of diffusion on the quadrupolar part of free induction decay and echo shapes are presented. These calculations show that diffusion will slow the decay of the quadrupolar part of a free induction decay and attenuate, broaden, and delay the appearance of a quadrupolar echo. A method for the separate measurement of $|\Delta m| = 1$ and $|\Delta m| = 2$ T_1 transitions in a spin 3/2 system subject to quadrupolar relaxation but not a spin temperature constraint is proposed. The spin echo apparatus used for the experiments is described in detail.

Microfilm \$2.75; Xerox \$6.80. 143 pages.

THERMAL CONDUCTIVITY STUDIES IN SODIUM CHLORIDE: PHONON SCATTERING BY CHEMICAL DEFECTS.

(Order No. Mic 61-1091)

Miles Vincent Klein, Ph.D.
Cornell University, 1961

The thermal conductivity of various NaCl single crystals was measured from 1.2 to 77°K. Small temperature differences were measured by a combination of carbon resistor thermometers and differential thermocouples. The temperatures themselves were deduced either from knowledge of the helium bath vapor pressure or from data taken with a helium gas thermometer. Much effort went into checking the consistency of the various temperature measurement processes; the results were satisfactory enough for the purposes of the present experiment, but minor inconsistencies remained.

The thermal conductivity of supposedly pure NaCl crystals from several sources was found to vary by as much as

two orders of magnitude at low temperatures. The conductivity of Harshaw crystals was particularly low. This effect was quantitatively related to the presence of an ultraviolet absorption band at $185 \text{ m}\mu$, known to be caused by oxygen-containing anionic impurities. Both phenomena were considerably reduced by treatment of the crystals in chlorine vapor at high temperatures; conversely both were enhanced by growing crystals from melts doped with NaOH , NaOD , or Na_2O_2 . There was little evidence, however, that the dopants appeared in these forms in the crystals. Infrared measurements and pH titrations suggested that the most likely result of the dopings was to introduce carbonate into the crystals.

The impurity scattered phonons very strongly at low temperatures; at 5°K approximately 3000 times more strongly than is usually observed for point defects. The cross section was proportional to the first power of the phonon frequency and could be assumed to be independent of the defect concentration. No model could be found to explain these results. Resonance scattering or absorption would probably give a large enough cross section, but not the right temperature dependence.

Experiments were performed in crystals doped with MnCl_2 . The manganese ions were first quenched into approximate solid solution and then allowed to age at room temperature. The kinetics of the precipitation that resulted was measured by electron spin resonance. There was surprisingly little change in the conductivity during aging; in particular the expected low temperature decrease did not appear. The conclusion was that the presence of clusters cannot be used to explain the greater than Rayleigh scattering cross section often observed with "point defects" at low temperatures. Several suggestions were advanced to explain the small conductivity changes that did result, namely a depression near the maximum and a gradual rise at higher temperatures towards the values obtained with an undoped crystal. The most promising of these involved the existence of an embryonic precipitation stage consisting of small, unstable clusters, followed by a true precipitation stage near the end of the aging process. It was thought that dislocations or other physical defects might serve as potential nucleation sites.

Microfilm \$2.75; Xerox \$8.20. 179 pages.

ELECTRICAL AND MAGNETIC PROPERTIES OF HOLMIUM SINGLE CRYSTALS

(Order No. Mic 61-2274)

Donald Lawrence Strandburg, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisors: Frank H. Spedding and Sam Legvold

Electrical resistivity and magnetic moment measurements have been made on three single crystal samples of holmium which were grown by a strain-anneal process and prepared in the form of rectangular parallelepipeds. The single crystals were cut so that samples with an a-axis, a c-axis and a $<10\bar{1}0>$ direction parallel to the long dimension were available for study. A cryogenic system was developed in which measurements of magnetic moment

could be made from 1.3°K to 300°K at magnetic fields from 250 to 18,000 oersteds.

Measurements with the field parallel and perpendicular to the c-axis revealed the existence of magnetic anisotropy over the entire temperature range. Basal plane anisotropy also appeared at temperatures below 100°K . The $<10\bar{1}0>$ direction was the direction of easy magnetization with an extrapolated effective moment per atom at saturation of 10.34 Bohr magnetons. The theoretical value is 10.0 Bohr magnetons. The effective moment per atom at saturation for the a-axis crystal was 9.0 Bohr magnetons. This value is just what one obtains if the moments are assumed to be parallel to the $<10\bar{1}0>$ directions lying 30° on either side of the a-axis.

Holmium was paramagnetic above 132°K . The magnetic susceptibility for fields in the basal plane obeyed a Curie-Weiss relationship, $X_a = \frac{0.0930}{T - 88}$, while for the field directed along the c-axis, $X_c = \frac{0.0930}{T - 73}$. Both basal plane and c-axis paramagnetic measurements gave an effective moment of 11.1 Bohr magnetons which may be compared to a theoretical value of 10.6 Bohr magnetons.

Isothermal basal plane measurements from 20°K to 132°K showed antiferromagnetic behavior with a transition to ferromagnetic behavior in fields above the critical field. For the a-axis sample, the transition occurred as a sharp rise to an intermediate value of magnetic moment followed by a second sharp rise to saturation values upon application of higher magnetic fields. The $<10\bar{1}0>$ sample was characterized by three such sharp rises.

The c-axis was very hard magnetically. No Néel point occurred, and isotherms were linear down to 30°K . Isotherms below 20°K showed an initial magnetization of about 1.7 Bohr magnetons followed by extremely flat magnetization curves.

The electrical resistivities of the single crystals measured from 4.2°K to 300°K . No anisotropy was observed for resistivity measurements in the basal plane. The degree of anisotropy between measurements parallel and perpendicular to the c-axis is indicated by the ratio of ρ_a , the basal plane resistivity, to ρ_c , the c-axis resistivity, at room temperature where $\rho_a/\rho_c = 1.70$.

At 20°K , plots of ρ_a and ρ_c versus temperature showed a very slight change of slope. At 132°K , the Néel point, ρ_a versus T changes slope and then continues to increase linearly while ρ_c goes through a minimum after having reached a peak at approximately 120°K . ρ_c then remains constant until approximately 150°K after which it increases linearly with increasing T .

Microfilm \$2.75; Xerox \$6.40. 132 pages.

PHOTOELECTRIC EMISSION AND THE WORK FUNCTION OF SILICON

(Order No. Mic 61-1043)

Charles Chen-ding Wang, Ph.D.
Stanford University, 1961

Photoelectric emission is a field that has long been exploited with great interest. Even though work concerning photoelectric emission is always troublesome

and painstaking, studies of photoelectric emission furnish valuable information about the interaction between light and matter. The techniques of photoelectric emission may also be used to investigate the optical and conduction properties of the materials from which the photoelectric emission is observed.

The photoelectric emission was observed from degenerate n-type silicon samples and p-type samples. An analysis of the spectral response yields information about the photoelectric response of the conduction electrons, the position of the surface states, and the band structure of the samples under investigation. The work reported here went further by applying the techniques of photoelectric emission to determine the difference in photoelectric work function between silicon samples of different doping. Even though the simple band model of solids is at best a poor approximation for degenerate samples of semiconductors, a study based on the simple band model of the effect of impurity content on the electron affinity is not altogether meaningless. It was found that the difference in electron affinity, as determined by spectral analysis, between an n-type sample with 2×10^{20} carriers/cm³ and a p-type sample with 10^{17} carriers/cm³ was about 0.28 to 0.35 ev, which agreed closely with the rough theoretical estimate of 0.30 ev.

Microfilm \$2.75; Xerox \$4.20. 79 pages.

ELECTRONIC BAND STRUCTURE OF CESIUM GOLD

(Order No. Mic 61-2435)

Van Earl Wood, Ph.D.
Case Institute of Technology, 1961

The lower-lying electron energy bands in CsAu arising from the levels of the valence electrons of the constituent atoms are computed using the method of matching wave functions at the surfaces of the atomic polyhedrons surrounding each atom. The radial parts of the wave functions required are determined by the quantum defect method. CsAu is assumed to be completely ionic. Calculations are carried out for the points in \vec{k} -space at the center of the first Brillouin zone and at its extrema in the [100] and [111] directions. The calculations indicate that CsAu is a semiconductor, in agreement with experiment, with a minimum energy gap, which is vertical, of about 2.3 ev located at the extremum of the [111] direction of the first zone. Limitations and some possible extensions of the calculations are discussed.

Microfilm \$2.75; Xerox \$3.00. 39 pages.

FIBER TEXTURE AND MAGNETIC ANISOTROPY IN EVAPORATED IRON FILMS

(Order No. Mic 61-2436)

Arthur Yelon, Ph.D.
Case Institute of Technology, 1961

The fiber texture and uniaxial magnetic anisotropy of evaporated iron films have been studied as a function of

film thickness. It is found that there are three textures present: [110], [111], and [221]. In thin films, the [111] texture is dominant. It is also found that the magnetic anisotropy is on the order of 2×10^4 ergs/cm³ for 350 Å films, and that it decreases for thicker films.

On the basis of this experiment, and information from earlier experiments, several theories of the origin of magnetic anisotropy in films are examined, and shown to be inadequate for iron films. A theory for the origin of this effect is proposed, based primarily on the magnetic energy associated with an array of oriented vacancy needles. These vacancy needles can also qualitatively explain the resistivity anisotropy and dichroism observed by other workers.

Microfilm \$2.75; Xerox \$3.00. 39 pages.

THE EXPERIMENTAL INVESTIGATION OF THE PROPERTIES OF HOT CARRIERS IN SEMICONDUCTORS

(Order No. Mic 61-2653)

Joseph Zucker, Ph.D.
New York University, 1961

Adviser: H. P. Kallmann

The term "hot carriers" is used to denote electrons and holes in a solid that, as a result of the application of an intense electric field, have a mean energy higher than the thermal equilibrium value. The study of the properties of hot carriers is of interest because the interactions of the carriers with the lattice and impurities are in general velocity-dependent. It is these interactions which determine such quantities as the mobility and the lifetime. The study of hot carriers also affords the opportunity to observe other regions of the conduction and valence bands than those occupied by thermal carriers.

The frequency dependence of the high-field mobility, the Hall coefficient and the recombination of excess carriers are the properties investigated in this work.

In order to investigate the frequency dependence of conductivity variations, measurements were made with 2.85 kMc microwave fields up to 12,000 volts/cm peak. From the comparison of dc pulse data with microwave data taken on the same samples it was concluded that there is no appreciable frequency effect at 2.85 kMc. This information is important for the interpretation of the recombination rate data, which are obtained with microwave excitation.

Measurements of the Hall coefficient were made on n- and p-type Ge as a function of dc pulsed electric fields up to 7,000 volts/cm. The data taken on p-type Ge support a prediction of E. Conwell that the Hall coefficient, R_H , of such samples should decrease in the hot carrier range even though carrier concentration remains constant. This prediction was based on Kane's calculation of the band structure of p-type Ge. Kane showed that the effective mass of the "light holes" approaches that of the "heavy holes" for states with high k -vector. For electrons in Ge no change in effective mass is expected, so there should be no dependence of R_H on electric field intensity in n-type Ge. This has been experimentally verified for

n-type samples oriented in a symmetry direction. However, for n-type samples oriented off an axis of lattice symmetry, the existence, in the absence of a magnetic field, of a sizeable transverse voltage due to anisotropy complicates the interpretation of the experimental results with magnetic field.

It is well known that the recombination of excess carriers at room temperature in moderately doped Ge proceeds via recombination centers with levels in the energy gap. This leads to a capture rate for electrons proportional to $\langle vA \rangle$ where v is electron speed and A is the capture cross section of the center. If the velocity-dependence of A is other than $1/v$, there should be a velocity dependent, and hence, electric field dependent capture rate. For samples with a high surface recombination velocity,

the lifetime is determined by the rate of diffusion of excess carriers to the surface. Since the diffusion constant depends on the average velocity of the carriers, the lifetime in such samples should also depend upon electric field intensity. The recombination of excess hot carriers in Ge has been investigated by measuring the change in photoconductivity caused by exciting the samples with high intensity microwaves. N- and p-type samples with surface and bulk limited lifetimes have been measured. In all samples measured, the photoconductivity was found to decrease as a result of the application of the high field. Information concerning the field dependence of the diffusion constant and of the cross sections of both bulk and surface traps can be obtained from the data.

Microfilm \$2.75; Xerox \$5.20. 105 pages.

PHYSIOLOGY

STUDIES ON THE MECHANISMS OF DELAYED IMPLANTATION IN THE MINK AND RAT

(Order No. 61-2946)

Robert Lowe Cochrane, Ph.D.
The University of Wisconsin, 1961

Supervisors: Associate Professor R. M. Shackelford
and Professor R. K. Meyer

A series of studies was made on the hormonal control of ovo-nidation and its delay in two species, the mink and the rat, with the objective of artificially increasing litter size in the former. The studies on the mink consisted of trying to hasten nidation, as measured by length of pregnancy, and increase litter size by treating pregnant intact animals with progesterone, estrogen, a combination of progesterone and estrogen, or uterine trauma. An attempt was made to determine the endocrine condition of the mink during delayed implantation by studying the uterine response to trauma at this time. The studies on the rat consisted of trying to cause delayed nidation in the non-nursing intact, spayed, or hypophysectomized rat by administering high levels of progesterone or, in the case of a number of the last type of animal, by making hypophyseal autografts. In cases where delayed nidation was obtained in the ovariectomized rat, studies were made on the sensitivity of the uterus to trauma during the delay in nidation and the role of estrogen, the decidual reaction, cortisone, and the adrenal gland in inducing ovo-nidation.

The experiments on the mink indicate that estrogen alone, or estrogen given at high levels in combination with progesterone, prolongs the delay in nidation and reduces the litter size in the intact mink. Progesterone administration appeared to cause a hastening of nidation but the results were not very pronounced. Some doses of progesterone appeared to reduce litter size but most of the levels had little or no effect. Uterine trauma had no effect on nidation time or litter size in the mink nor did it suc-

ceed in eliciting a true decidual response during the period immediately after ovulation.

The studies on the rat show that the administration of high levels of progesterone in the absence of the ovaries or hypophysis brings about a delay in nidation until such times as minute quantities of estrogen are included in the treatment. Pituitary autografts cause a similar delay in implantation until such time as small amounts of estrogen are administered to the animal.

The uterus of the spayed progesterone-treated rat exhibiting delayed implantation responds to mechanical trauma with the formation of deciduomata. The decidual reaction and cortisone apparently will not induce nidation of blastocysts undergoing a delay in implantation as a result of spaying and injecting the mothers with progesterone. Estrogen will induce implantation of these "delayed blastocysts" in the adrenalectomized animal and, therefore, it does not seem to act through the adrenal gland as was once presumed to be possible.

The endocrine mechanisms controlling nidation and its delay in the mink and rat appeared to differ appreciably. These differences were discussed and comparisons were made to the implicated mechanisms of delayed implantation and nidation in other species.

Microfilm \$2.75; Xerox \$8.80. 194 pages.

THE VERATRINE RESPONSE IN FROG MUSCLE AS STUDIED BY INTRACELLULAR ELECTRODES

(Order No. Mic 61-2644)

John Terry Conrad, Ph.D.
New York University, 1961

Adviser: Alexander Sandow

Intracellular recordings of the resting and action potentials from single cells of the sartorius muscles of *Rana*

pieniens have been used to study the veratrine response. Variations in these bioelectrical responses were induced by altering the extracellular concentrations of potassium, calcium, sodium, as well as nitrate replacement of chloride. The results of these experiments are:

1. Linear regression analysis of the control data demonstrated a relationship between the height of the negative after-potential and the resting potential. A change from a phosphate buffered Ringer's solution to one containing a bicarbonate buffering system will lessen the slope of the regression curve. Solutions containing veratrine, veratridine and cevadine disturb the relationship so that the height of the negative after-potential no longer bears a linear relationship to the height of the prestimulation resting potential.
2. Muscles, completely immersed in veratrine, veratridine and cevadine gave characteristic "veratrine responses" upon single shock stimulation at a concentration of 10^{-6} W/V. Multiple action potentials are obtained consistently when there is an interval of at least five minutes between stimuli. Multiple action potentials were also found in massively stimulated muscles totally immersed in veratrine solutions. These findings are in opposition to those of Burns, Frank and Salmoiragh (Brit. J. Pharmacol. 10:363-370, 1955) who found that frog sartorii, completely immersed in veratrine solutions, do not produce after-discharges upon single shock stimulation.
3. Replacement of the chloride in the Ringer's solution by nitrate resulted in an approximately twofold increase in the duration of the negative after-potential in unveratrized muscle. Ringer's solutions containing nitrate plus veratrine curtailed the veratrine response.
4. Reduction of the sodium content of the Ringer's solution to one half of normal curtailed the veratrine response. There was a lowering of the height of the veratrine-enhanced negative after-potential and a loss of action potential height. High sodium (2 x normal) prolonged the after-discharge period.
5. Low potassium (50% to 0% of normal) caused a slight to marked increase in the duration of the negative after-potential, resting potential and height of the negative after-potential in veratrized cells. A two to four times increase in potassium lowered the resting potential, overshoot, height of the negative after-potential and duration of the negative after-potential, as compared to the corresponding veratrine controls.
6. High calcium (5 x normal) increased the height of the negative after-potential in unveratrized cells. In veratrized cells, it reduced the duration of the negative after-potential, as well as the frequency of the spike activity during the veratrine response. Low calcium (10% of normal) resulted in multiple responses to single shock stimulation in unveratrized cells, along with a lowering of the resting potential, overshoot and height of the negative after-potential. In veratrine treated muscles, low calcium increased the duration of the negative after-potential to the point that the membrane showed great instability in potential level.
7. Variations in the K/Ca ratio of the Ringer's solution, with and without veratrine demonstrated that high calcium protected the muscle from changes due to

potassium variations. Low calcium effects were more marked, although the effects were diminished somewhat in low potassium solutions.

8. Veratridine and cevadine were both capable of producing a "veratrine response." The repolarization rate of veratridine was about $3\frac{1}{2}$ times slower than that of cevadine.

It is thought that the distinctive potential records obtained during the veratrine response are probably due to abnormal ionic fluxes through the cellular membrane. It is postulated that veratrine (and related drugs) work by structurally altering the membrane and that these changes are responsible for the changed ionic fluxes.

Microfilm \$2.85; Xerox \$9.90. 217 pages.

EFFECT OF FATAL HYPOXIA ON LARGE VESSEL HEMATOCRIT, PLASMA PROTEIN CONCENTRATION, AND PLASMA OSMOLARITY: EXPERIMENTAL APPROACH TO THE SUBJECT OF EXTRA PLASMA.

(Order No. Mic 61-2831)

Harold Thomas Hamre, Ph.D.
The Ohio State University, 1961

It is generally accepted that the small blood vessels of the body could contain the entire blood volume if they were all open at once. This implies that a considerable proportion of the small vessels must be empty or nearly empty at any one time. It seems established that the small vessels contain low hematocrit blood. Relative to the large vessels, small vessels may be viewed as containing extra plasma. Any treatment that increases the number of small vessels open at one time should increase the volume of extra plasma. The aim of this experiment was to open more small vessels at one time and thus to increase the amount of extra plasma, and from this to estimate the potential volume of the collapsed vessels.

Hypoxia is known to be a powerful stimulus for small vessel dilation. The most extreme hypoxia should be attained soon after apnea and the cessation of circulation. Preliminary experiments showed that rapid (15 minutes) hypoxic death did not result in increased extra plasma. This was perhaps because of agonal reflex closure of some vessels. However, slowly developing hypoxic death (over 40 minutes) seemed to result in an increase in the volume of extra plasma. These conditions were used in the experiment.

The changes were measured by determination of the hemoglobin and plasma protein concentrations and the large vessel hematocrits. In the rat slowly developing hypoxia terminating in death resulted in a rise of 45 per cent in the fraction of extra plasma. If the Hct_s/Hct_L ratio remained constant and there was no undetected net loss of plasma protein, then there was an increase of 27 per cent in the volume of extra plasma and a 27 per cent increase in the volume of small vessel blood. This small increase in the volume of extra plasma suggests that few, if any, empty small vessels exist in the normal animal.

and that the potential capacity of the small vessels is only slightly larger than the normal actual capacity. Factors affecting the validity of this conclusion have been considered. Microfilm \$2.75; Xerox \$5.20. 103 pages.

**THE EFFECTS OF ADRENALINE ON
THE HEAT BALANCE OF CATS, DETERMINED
BY A NEW CALORIMETRIC SYSTEM.**

(Order No. Mic 61-1062)

Lorne Allister MacHattie, Ph.D.
The University of Buffalo, 1961

A new gradient calorimeter was designed, constructed and used to study the effects of adrenaline on the heat balance of cats.

A theoretical treatment of gradient calorimeter design on new principles showed that an accurate fast-response gradient layer need not be covered with closely-spaced thermal detectors, as has been the usual practice (e.g. in the excellent thermoelectric gradient layers developed by Benzinger et al.). Thus a considerable simplification in layer structure was made possible.

The design selected for the cat calorimeter, using only 14 thermistors on each side of the layer (one thermistor to each 330 cm^2) provided, at the setting that was used in the present animal experiments, a time-constant of 15 secs with a recording sensitivity of 12.4 cm per cal/sec (on a 0 - 2.5 mv Minneapolis-Honeywell recorder of chart width 10").

Design theory: The relations among layer dimensions and material constants, thermal response time, thermal sensitivity and the closeness of spacing of detectors required to assure accurate registration of total heat flow were presented in the form of three equations. After some design choices had been made, these three equations were brought together in a graphical form which permitted the selection of a design to provide the best compromise in layer properties.

The theory of a device employing thermal feedback to shorten the response-time of the layer (an original idea of A. C. Burton, slightly modified in the course of this work to render the system stable) was worked out and graphically presented. This device made it possible for the time-constant of the calorimeter's response to be varied at will.

Calibration and response-characteristic tests confirmed the theoretical predictions as to the functioning of the calorimetric system.

Adrenaline ($4 \mu\text{g}/\text{kg}\cdot\text{min}$ for 20 mins) was found in 19 experiments on three cats to decrease the heat loss by about 8% while at the same time increasing the heat production (calculated from O_2 consumption) by 9%. Accurate measurements of central body and average skin temperatures were combined with the heat production and loss results to compute the weighting factors for obtaining average body temperature from average skin and central body temperatures in the cat. The average value of the weighting factor for central body temperature was 0.415. It increased with the adrenaline-caused vasoconstriction and decreased with the after-dilatation (maximum and minimum 4-min-period values 0.73 and 0.30). The tissue insu-

lation increased on the average from a control value of 0.186 clo to about 0.28 clo during the course of the infusion.

A method was proposed for obtaining a relative measure of the specific thermal conductivity of the surface tissues. By this method, that of cat tissues appeared to have been decreased during the infusion to about $\frac{1}{4}$ of the control value.

The concept of a 'metabolically-effective average body temperature,' T_m , was developed. Calculations of the changes in T_m during the adrenaline infusion made possible an estimation of the extent to which thermal stimulation of biochemical reaction rates contributed to the observed calorogenic action of the infused adrenaline. Thermal stimulation appeared to account for about 20% of the metabolic increase observed in these experiments.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

**THE INFLUENCE OF BLOOD AND
TISSUE EXTRACTS UPON
ERYTHROPOIESIS IN THE RAT**

(Order No. Mic 61-2637)

Paul Thomas Medici, Ph.D.
New York University, 1956

Adviser: Albert S. Gordon

The purpose of this investigation was to examine the influence of plasma and some blood and tissue extracts upon the formed elements of the peripheral blood and bone marrow.

Treatment of rats with boiled filtrates of hog duodenum, stomach and kidney produced a diminution in the number of peripheral red cells, hemoglobin concentrations and hematocrit values while liver extracts caused a significant rise in the red cell numbers. Bone marrow analyses showed that the erythroid-myeloid ratios were lower in the groups receiving the gastro-intestinal and kidney extracts.

In the series of rats treated with whole serum obtained from the same strain of rats rendered anemic with phenylhydrazine, significant elevations were noted in the peripheral red cell, hemoglobin and reticulocyte values. This treatment also induced a substantial rise in the erythroid-myeloid ratio within the bone marrow of these animals. Rats receiving serum from phenylhydrazinized rats showed a significant increase in total cellular volume with no alteration in total blood volume and plasma volume. Marked reductions in albumin-globulin ratios were produced by these injections due to both a lowering in the albumin fraction and an elevation in the gamma globulin component. No significant changes in lipoprotein values were evident.

Significant increases in red cell counts and reticulocyte percentages were observed in animals injected with a boiled acid filtrate of serum obtained from rats repeatedly injected with phenylhydrazine. Hemoglobin values were unaffected by this treatment while hematocrit levels were lowered slightly. Daily injections of this serum extract produced marked rises in nucleated erythroid cells associated with a leukopenia in the bone marrow. These changes resulted in an elevation in the erythroid-myeloid

ratio. Both total blood volumes and plasma volumes were increased slightly following injections of this serum extract while the cellular volumes remained unchanged. A lowering of the albumin percentages and elevation in gamma globulin resulted in a drop in the albumin-globulin ratio in this series of rats. The alpha lipoprotein levels were elevated along with a lowering in the combined beta and gamma fractions.

Boiled extracts of plasma obtained from rabbits, previously rendered anemic with phenylhydrazine, produced significant rises in the red cell, reticulocyte and hematocrit values in rats. A less marked elevation in only the erythrocyte numbers was induced by the extracts of bone marrow. Decreases in red cell counts were produced by splenic and thymic extracts. The plasma extracts induced significantly higher percentages of nucleated red blood cells in the bone marrow of the test rats. This resulted in elevated erythroid-myeloid ratios. Serum albumin-globulin ratios in rats injected with these various tissue extracts were lowered significantly in all instances except one, namely, the group treated with the plasma extract. Following administration of packed blood cells, muscle, bone marrow, spleen, liver and lung extracts a significant elevation occurred in the alpha-1 component of the globulins. The alpha-2 globulin fraction was elevated in all groups tested. Brain and thymus extracts produced significantly higher values than noted in the normal untreated animals. Gamma globulin values were elevated in the rats injected with extracts of muscle, brain, spleen and lung. Significant elevations in the alpha fraction of serum lipoproteins were elicited by bone marrow extracts. This change was associated with decreases in the combined beta and gamma lipoprotein levels.

The present studies afford further and more substantial evidence for the existence of a circulating humoral principle(s) which specifically stimulates erythropoiesis.

Microfilm \$2.75; Xerox \$3.00. 59 pages.

A STUDY OF NITROGEN EXCRETION IN INSECTS

(Order No. Mic 61-2438)

James Lamar Nation, Ph.D.
Cornell University, 1960

Excreta of insects representing four orders and several types of excretory systems has been examined for nitrogenous compounds. Separation of individual compounds in excreta was accomplished by paper chromatography of fecal extracts in the following solvent systems: ethanol-acetic acid-water (85:5:10 v/v/v), butanol-methanol-benzene-water (2:1:1:1 v/v/v/v), and isopropanol-water (10:3 v/v).

The results show that larvae of Galleria mellonella (L.) excrete hypoxanthine, uric acid, urea, sodium chloride, and an unidentified purine-like compound. Only hypoxanthine and uric acid could be detected in excreta dissected from adults of Galleria. In both adults and larvae uric acid was the predominant compound detected. The unidentified compound showed an absorption peak in ultraviolet light at 280 m μ in pH 12 phosphate buffer and at 265 m μ in 0.1 N HCl. It could be converted by xanthine oxidase

prepared from milk to a compound showing a peak of absorption at 295 m μ in pH 8 phosphate buffer. This is interpreted as its conversion to uric acid. It was shown that Galleria larvae still excreted uric acid and hypoxanthine when fed only on beeswax containing stored pollen, but in decreased amounts.

Only uric acid could be detected on chromatograms of Galleria larval blood. Quantitative estimation of uric acid in Galleria larval blood gave a value of $5.12 \pm 3.45 \mu\text{gm}$. uric acid per 100 μl . blood.

Uric acid was shown to be the major nitrogenous excretory product of Acheta domesticus (L.), Periplaneta americana (L.), Oncopeltus fasciatus (Dallas), Tenebrio molitor L., and Malacosoma americana (Fab.). Neither hypoxanthine nor the unidentified compound was detected in excreta of these insects.

Allantoin and urea were detected in excreta of Tenebrio larvae. Urea was present in excreta of Oncopeltus nymphs and/or adults.

The data suggest that uricogenesis in insects is similar, but may not be identical, to uricogenesis in birds. Uric acid intermediates in the excreta of Galleria suggest the possibility that xanthine oxidase is different from xanthine oxidase in other insects. Another possible explanation is that there is an over-all basic difference in the Malpighian system of Galleria, such as permeability relationships. Microfilm \$2.75; Xerox \$3.60. 63 pages.

THE SORPTION OF WATER, SODIUM AND POTASSIUM IN THE SMALL BOWEL OF DOGS DURING NICOTINIC ACID DEFICIENCY

(Order No. Mic 61-2153)

Ralph Alfred Nelson, M.D., Ph.D.
University of Minnesota, 1961

The purpose of this study was to determine the effect of a deficiency of nicotinic acid on the sorption of water, sodium, potassium and glucose in the small intestine of the dog.

Tests of sorption of these substances were done in trained unanesthetized dogs with Thiry-Vella loops of duodenum and ileum before, during and after treatment of nicotinic acid deficiency.

It was noted that:

- 1) Isolation of intestinal loops for periods up to 99 days, in which only custodial care was given, did not affect the absorption of water and sodium.
- 2) During the control period of predeficiency, sorptive rates of water, sodium and potassium in the canine small intestine were of the same magnitude as previous published data.
- 3) In the duodenum, during nicotinic acid deficiency, insorption of water, sodium and potassium were severely reduced. Exsorption of water and sodium moderately declined but exsorption of potassium was unaffected.
- 4) In the ileum, during the deficient state, insorption of water, sodium and potassium decreased greatly. Exsorption of water and potassium declined also but exsorption of sodium was unaffected.
- 5) During deficiency, enterosorption of water and sodium occurred. The enterosorption of these substances was greater in the duodenum than ileum.

6) Diarrhea occurred in deficiency after the onset of the enterosorptive period of water and sodium.

7) Treatment of the deficient state with nicotinic acid stopped enterosorption in 3 of 5 dogs. Nicotinic acid was more effective in improving sorptive rates in the ileum than in the duodenum.

8) None of the animals treated showed a return of their insorptive rates of water and sodium to predeficiency levels as far as absolute values were concerned. The sorptive ratios, however, for water and sodium did revert to predeficiency levels in all dogs that responded to treatment.

9) Close relationships were found between the net quantities of sodium and water sorbed and between the net quantities of sodium plus potassium and net water sorbed. These relationships persisted whether absorption or enterosorption occurred.

10) The amount of water insorbed was related to the amount of water exsorbed during predeficiency and deficiency periods.

11) Glucose was not enterosorbed during the deficient state but the quantity absorbed was related to the quantity of Na₂₂ insorbed. The duodenum absorbed more glucose than the ileum for a given absorption of Na₂₂.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

COMPARATIVE STUDIES OF THE HISTOLOGY AND PHYSIOLOGY OF SALIVARY GLANDS IN SOME SPECIES OF RODENTS

(Order No. 61-2937)

Lorraine Cecelia Peissner, Ph.D.
The University of Oklahoma, 1961

Major Professor: Harriet Harvey

Investigations reported herein fall into three major and related problems. The first phase was a comparative histological study. Salivary glands from fifty-five animals representing twelve species and six families of Order Rodentia were included in this part of the research. Some structural variation was observed in submaxillary tissue from each species. Parotid and sublingual glands, however, showed strong general resemblance in the histology of the respective glands.

Sex dimorphism in submaxillary gland structure has been reported for laboratory mice. Differences are based on tubule diameter, terminal tubule cell granulation, and gross weight. These aspects are all greater in male than in female submaxillary tissue. The second part of this study was to establish the extent of such dimorphism in Order Rodentia.

In three species: grasshopper mouse (Onychomys leucogaster), pack rat (Neotoma floridana), and guinea pig (Cavia porcellus), sex dimorphic submaxillary glands were found. Tubule diameter and terminal tubule cell granulation were characteristically greater in tissue from male grasshopper mouse and male pack rat. In addition to tubule difference, acinar cells of the male pack rat submaxillary were notably larger than female acini. A more subtle dimorphism was uncovered in guinea pig submaxillary glands.

Serous demilune cells, scattered among serous-like acini in female glands, were not observed in male tissue.

Structural sex dimorphism in submaxillary tissue led to investigations of possible physiological differences between glands of males and females. In light of reported sex differences in salivary gland amylolytic activity, it became of interest to determine activity levels of three other glycosidases: lactase, maltase, and sucrase, in submaxillary and parotid glands from guinea pigs, laboratory rats and mice. Pancreatic and intestinal tissues were likewise analyzed.

Lactase activity was negligible in tissues other than mouse intestine; no sex difference was revealed in this instance. Male guinea pig tissues, in general, proved to be more capable of hydrolyzing maltose than female tissues. A similar sex difference was recognized in rat submaxillary gland and intestine, and in mouse submaxillary gland and pancreas. Intestinal tissue only was capable of hydrolyzing significant amounts of sucrose. Male guinea pig tissue surpassed all other control animals in this respect. No significant differences were observed between male and female sucrase activity levels in rats and mice.

Analyses of tissues from pregnant and lactating guinea pigs suggested that estrogens are prone to suppress maltase production in submaxillary glands, pancreas, and intestine. Tissues from mice subjected to gonadectomy and replacement therapy varied considerably in glycosidase levels. In general, estrogens tended to enhance enzyme activity; androgens appeared to exert an inhibitory influence.

An ancillary study of the effect of free HCl upon glycosidase activity demonstrated the ability of tissues to hydrolyze maltose to glucose was greatly increased. Hydrolysis of lactose and sucrose was relatively unaltered.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

EFFECT OF EXOGENOUS PROGESTERONE ON REPRODUCTIVE ACTIVITY IN THE BEEF HEIFER

(Order No. Mic 61-2270)

Donald Edward Ray, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Dr. R. M. Melampy

Experiments were conducted to determine the effect of exogenous progesterone on estrous response, conception rate, pituitary gonadotrophin content, ovarian morphology and endometrial epithelial cell heights of grade Hereford heifers. The trials involved a total of 53 heifers approximately 14-24 months of age. Eleven heifers received 560 mg. progesterone followed by 750-2250 I.U. of PMS 14 or 15 days later. Heat was observed 2-38 days after PMS injection, but only 12% of the animals conceived from inseminations at this estrus.

A group of 27 heifers received a single injection 0.76 mg. Repositol progesterone per lb. of body weight. Nine animals were injected at each of the following stages of the estrous cycle: 0 (heat); 8; and 16 days postestrus. From each group 3 were slaughtered 8 days and three 16

days post-injection. The remaining 3 heifers in each group were slaughtered 2-4 days after first post-treatment estrus. Fifteen animals acted as controls, 5 being slaughtered at each of the following stages: 1; 8; and 16 days postestrus. Estrus was observed in treated animals 12-19 days post-injection. Animals receiving progesterone injections at heat had the shortest interval to next estrus (12-14 days), whereas those injected at day-8 of the cycle exhibited the longest interval from injection to heat (16-19 days).

Pituitary FSH and LH potencies were evaluated by testes weights and ventral prostate weights, respectively, of immature hypophysectomized rats. Pituitary FSH and LH potencies were significantly higher in control animals than in the treated group. However, no significant differences in these two hormones were observed in the treated group with respect to stage of cycle injected or interval from injection to slaughter. LH potency was significantly lower in control heifers slaughtered 1 day post-estrus than 8 and 16 days postestrus. Prolactin levels were also evaluated in the pituitaries from control animals. No differences were detected in prolactin potencies which could be attributed to stage of estrous cycle.

Average corpus luteum diameter was significantly greater in control animals, indicating that exogenous progesterone interfered with formation and/or maintenance of the corpus luteum. A similar analysis of the diameters of the largest ovarian follicles in these animals failed to indicate any significant differences between control and treated groups.

Cell heights of glandular epithelium of the endometrium tended to be higher in control uteri, suggesting that the endometrium of the treated group was possibly subfunctional. The lowered fertility observed following progesterone treatment could be partly explained on this basis.

Microfilm \$2.75; Xerox \$4.60. 86 pages.

INTRACELLULAR DISTRIBUTION OF THE PHOSPHATASE ACTIVITY OF THE FROG ADENOCARCINOMA (LUCKÉ TUMOR)

(Order No. Mic 61-2594)

Abraham Schlein, Ph.D.
New York University, 1958

Adviser: Professor M. J. Kopac

One of the problems in the field of fundamental cancer research is the correlation of structure with function in subcellular particles. In this regard, the frog renal adenocarcinoma (Lucké tumor) is useful since comparable control material in the form of normal kidney cells, are readily available.

It is possible to determine the presence of large renal adenocarcinomas by careful palpation of living frogs. The adenocarcinoma can be easily identified after the frogs are opened, as elevated surface nodules, white or ivory-white in color, whereas the normal frog kidney is reddish-brown, small and flat.

In the present study, the tissues of normal kidneys and renal adenocarcinomas from frogs were homogenized in

0.25 M sucrose. The homogenates, by differential centrifugation, were then separated into fractions consisting of nuclei, mitochondria, microsomes, and the supernatant. The alkaline phosphatase activity of each fraction was determined using glucose-1-phosphate, glucose-6-phosphate, adenosine-5-phosphate, and ribose-5-phosphate as substrates. Since the amount of material isolated was small, micro-methods (20 μ l to 50 μ l) of analysis were adapted. The amount of phosphate liberated from the substrate was determined photometrically. In order to equilibrate for the differences in the various fractions and tissues, the activity was expressed as μ M phosphate per mg nitrogen.

The nitrogen and phosphorus content of the normal and adenocarcinomatous kidney were the same on a dry weight basis. On a wet weight basis, however, the normal kidney contained more nitrogen and phosphorus than the Lucké tumor. The normal kidney contained 82.1 per cent water as compared to 86 per cent water in the tumorous kidney. The percentage of total phosphorus in each of the fractions was strikingly different when the normal tissue was compared to the adenocarcinoma. The supernatant fraction of the adenocarcinoma contained approximately twice as much phosphorus as its normal counterpart. There were only slight variations in the nitrogen values when the normal and adenocarcinomatous fractions were compared. The supernatant fraction of the adenocarcinoma also had a significant amount of endogenous inorganic phosphorus. The other fractions contained small amounts, if any, inorganic phosphorus.

The results of the enzymatic analysis showed that the activity of alkaline phosphate, using glucose-1-phosphate as a substrate, was greatly reduced in the tumor as compared to the normal kidney. The mitochondrial and microsomal fractions of the normal kidney contained about 70 to 80 per cent of the total activity. The nuclei accounted for 15 to 20 per cent of the activity. The tumor fractions gave comparable results in the mitochondrial and microsomal fractions. The supernatant fraction of the tumor, however, contained a greater per cent of the total activity than in the normal kidney. The unilateral and bilateral adenocarcinoma, and even carcinomatous portions of a normal kidney all showed the same minimal activity. The normal unilateral and bilateral kidneys, as well as normal portions of a tumorous kidney, and the remaining normal kidney from the nephrectomized frog showed similar activities. The only difference occurred in the adenocarcinomas that metastasized to the liver. Here, the activity of the microsomal fraction was greater than that found in the renal adenocarcinoma, but less than normal kidney values.

The other substrates, glucose-6-phosphate, adenosine-5-phosphate, and ribose-5-phosphate, when incubated with either normal or tumorous fractions gave similar results to that obtained with glucose-1-phosphate. All the substrates had minimal activity with the tumor fractions and greatly increased activity with fractions obtained from normal kidneys. Glucose-1-phosphate had the highest activity of the substrates with either the normal or tumor fractions. Microfilm \$2.75; Xerox \$6.60. 137 pages.

CALCIUM AND STRONTIUM
SECRESSION BY THE
LACTATING GOAT

(Order No. Mic 61-1093)

Arthur Robert Twardock, Ph.D.
Cornell University, 1961

The lactating animal preferentially secretes calcium over strontium from blood to milk by a factor of approximately two to one. The purpose of this study was to investigate the mechanism of Ca-Sr discrimination by the mammary gland. Methods used included long-term, continuous intravenous infusions into lactating goats and determinations of Ca-Sr binding by blood and milk proteins.

A technique was developed whereby continuous intravenous infusions were performed for as long as 180 hours at rates as low as 400 ml per 24 hours with a standard deviation of $\pm 5\%$. Using this infusion technique, the effect of route of administration (oral versus intravenous) on the concentration of radiocalcium and radiostrontium from blood to milk was studied; no difference was observed. Infusions of stable calcium and stable strontium into lactating goats were also performed. An apparent maximum safe rate for long-term intravenous calcium infusion into goats was 0.15 mg Ca/kg/min. Plasma calcium was elevated to levels as high as 36 mg %. Primary symptoms of calcium toxicity were pyrexia and depression. Pulse rates varied with the stage of infusion, dropping at the onset and rising after termination. Stable calcium infusions produced marked decreases in blood and milk

levels of orally ingested Ca^{45} and Sr^{85} as a result of increased renal excretion. Renal discrimination against strontium in favor of calcium disappeared during infusion. Results of stable strontium infusion differed from those of stable calcium infusions; during stable strontium infusion levels of orally ingested Ca^{45} in blood and milk remained constant while levels of Sr^{85} increased two-fold. Maximum concentrations of stable strontium were 4.6 mg % in blood plasma and 39 mg % in milk.

Although infusions produced large changes in stable and radioisotope concentrations in blood and milk, the relative movement of calcium and strontium from blood to milk was unaffected. After termination of stable calcium infusions, a drop in blood calcium below pre-infusion levels was consistently noticed. It is suggested that depression of parathyroid activity by high blood calcium might have been responsible for the decreased blood calcium. After injection into the mammary gland via the teat canal, Ca^{45} and Sr^{85} moved equally into the blood stream.

In *vitro* labeling of whole goat's milk with Ca^{45} and Sr^{85} demonstrated that small fractions of milk calcium and strontium were nonexchangeable with the added radio-elements after time intervals up to 150 hours. Milk proteins bound approximately 10% more Sr^{85} than Ca^{45} following *in vitro* and *in vivo* labeling. Since blood plasma proteins bind more calcium than strontium, it was concluded that some factor other than protein binding is responsible for the preferential secretion of calcium over strontium into milk.

Microfilm \$2.75; Xerox \$5.60. 112 pages.

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

THE POLITICAL AND SOCIO-ECONOMIC IDEAS AND THEORIES OF THEODOR HERZL

(Order No. Mic 61-2640)

Joseph Adler, Ph.D.
New York University, 1961

Adviser: Dr. Albert Somit

Although many books and articles about Theodor Herzl, the founder of the modern Zionist Movement, cursorily mention his theoretical political and socio-economic thought, the authors do so as if they were reluctant to dispel the "Herzl legend," which long has pictured him primarily as pamphleteer, organizer, and practical negotiator. Romanticized and lionized by two generations of literati, Herzl has, in fact, been virtually ignored as an original thinker and theorist. Even such standard works on political, economic, and social thought as George Sabine's A History of Political Theory, Joseph Schumpeter's History of Economic Analysis, and Harry Elmer Barnes and Howard Becker's Social Thought from Lore to Science do not mention Herzl's theoretical contributions. This is rather strange, at the very least, when one considers that the doctrines and theories formulated by Herzl stirred millions of people and led to the birth of a new nation--Israel.

The writer believes that a proper understanding of Herzl's ideas and theories would win for him his rightful status in European political and socio-economic thought. Many of his theories presaged twentieth century developments and almost all of his ideas merit attention for their spark of originality and clarity of expression. To comprehend fully the work of this man, this study attempts to examine in detail the genesis and growth of his ideas as well as the historical setting in which these concepts were formed. To accomplish this purpose, the writer has divided his dissertation into five parts.

Part One--The Historical Background of European Jewry, 1700-1900

The chapters under this heading describe the historical milieu that made possible the accomplishments and ideology of Theodor Herzl. These pages record the penetration of European civilization, especially Western culture, into the lives of European Jewry--a penetration that laid the foundation for Herzl's synthesis of European ideology with the age-old yearning of Jewry for a national homeland and social justice.

Part Two--The Life of Theodor Herzl

This section includes a chronological and descriptive account of the major forces, events, and persons in Herzl's life. The writer has not attempted to present a biography;

in view of the many biographies available, this is scarcely necessary. Instead, stress has been placed on those incidents and developments that set the stage for the emergence of Herzl's political and socio-economic ideas.

Part Three--The Role of the State: Herzl's Formative Concepts

Part Three consists of an analysis and evaluation of Herzl's early views on the role of the state with regard to Hegelianism, capitalism, labor, socialism, democracy, aristocracy, and elitism. A delineation of some of the sources from which Herzl drew his inspiration is included.

Part Four--The Jewish State: A Political Solution to the Jewish Question

These chapters include an exposition of Herzl's plan for a Jewish state. The sources that influenced him are examined in detail.

Part Five--The Jewish Commonwealth: An Experiment in Co-operation

This section explores Herzl's abandonment of the idea of creating a traditional type of national state and his attempts to visualize a Jewish commonwealth based on the principles of co-operation and social justice. Consideration is given to the political and socio-economic theories outlined by Herzl in his description of this commonwealth and to the sources from which many of his ideas were derived. Microfilm \$4.95; Xerox \$17.55. 386 pages.

THE CONSPIRACY THEORY OF POLITICS OF THE RADICAL RIGHT IN THE UNITED STATES

(Order No. Mic 60-4362)

William Chandler Baum, Ph.D.
State University of Iowa, 1960

Adviser: Associate Professor E. Lane Davis

This is the first known analysis of the political ideology and activity of the contemporary radical right in the United States. The purpose of this work is to systematically construct the political ideology of the radical right and to explore the implications of this ideology as it relates to American politics and society.

The term "radical right" is used to designate those persons and groups who accept many traditional tenets of American conservatism (attachment to private property, a repugnance for social welfare legislation, pessimism

concerning human nature, and a belief in differing human qualities), and who subordinate this conservatism to the intense conviction that the present world is controlled by an evil and omnipotent conspiracy. The radical right uniquely combines elements of conservatism with the belief that the world must suddenly be overthrown and the conspiracy eradicated.

According to the radical right, the world is divided into two camps: good and evil. These camps cannot co-exist because the forces of evil are engaged in a wicked conspiracy to subvert the forces of good. The radical right defines evil to include Communism, the Jew, the Negro, the Socialist, and the New Dealer. The radical right believes itself to be working for both God and Americanism when it advocates that evil must be extirpated from the world.

Because the evil conspiracy is thought to be in control of government, the radical right generally considers political activity to be useless. Many members of the American radical right consider violence to be the only method for combatting this conspiracy. The battle between good and evil will soon be fought in a final, cataclysmic showdown. A literal Armageddon is hoped for by the radical right.

In discussing the existence of the radical right, it is the thesis of this study that the radical right can only be explained in terms of the personality of its members. The radical right cannot tolerate ambiguity and reduces the world into the forces of good and evil. The latter force threatens both the moral integrity and the physical well-being of the members of the radical right. The ideology and politics of the radical right reflects this fear. Consequently, the politics of the radical right will concentrate on such things as mental health programs and fluoridated water. One constitutes an invasion against moral purity, the other threatens physical wholeness. This pattern of threat and threat-reaction is central to radical right politics. These conclusions given strong support to Lasswell's hypothesis that political activity may be the result of externalized personal aggressions.

There are approximately five to ten million people in the United States who probably ascribe to the views of the radical right. Since these views are solidified and reinforced by a press which monthly circulates millions of pieces of radical right propaganda, the radical right constitutes a more serious political movement than is generally acknowledged.

Microfilm \$2.75; Xerox \$7.40. 156 pages.

THE OFFICE OF SECRETARY OF STATE IN GEORGIA

(Order No. Mic 61-1460)

William Joseph Harkins, Ph.D.
Emory University, 1960

Director: L. M. Holland

This dissertation has as its primary objective the evaluation of the status of the office of secretary of state in Georgia, based upon a thorough study of its history, functions, organization, and the roles of the department

head. Since no known detailed study has been made of the office encompassing the above criteria, it was thought that the data and conclusions obtained through such a study would constitute a meaningful contribution to existing knowledge concerning Georgia government.

The procedures followed were to procure pertinent information on the office of secretary of state nationally, concerning the above standards; to acquire necessary data regarding the Georgia department; to compare the two sets of data; to arrive at a limited number of recommendations for the improvement of the Georgia office; and finally, to attain an over-all evaluation of the Georgia office. The principal methods used to obtain data were personal interviews with incumbent secretaries of states and members of their staffs, letters of inquiry forwarded to state departments, a resort to primary source materials, such as state laws, codes, and official manuals, and an examination of selected secondary materials.

The findings of the study pointed out clearly that the office of secretary of state in Georgia is currently one of the most prominent state departments in American state government. They showed that the Georgia office ranked among the top seven state departments in regard to the number of employees, the extensiveness of administrative structure, the amount of annual operating funds, the number and importance of functions, and the number and significance of the roles of the department head. The findings further indicated that the trend, particularly for the past three decades, has been toward a substantial increase in departmental growth and importance. Three constructive suggestions have been made that would strengthen the Georgia state department.

Microfilm \$2.75; Xerox \$9.45. 206 pages.

THE SUPREME COURT, TOTALITARIANISM, AND THE NATIONAL SECURITY OF DEMOCRATIC AMERICA, 1941-1960.

(Order No. Mic 61-1462)

Robert Larry Keele, Ph.D.
Emory University, 1960

Director: Ronald Howell

Throughout the past two decades the forces of totalitarianism have threatened the security and the preservation of democratic America. The United States Supreme Court has been confronted with controversial constitutional questions growing out of the unparalleled expansion of governmental power in the domain of national security. This dissertation discusses and analyzes the major decisions of the Supreme Court that relate to the problems of national security and the Court's concept and treatment thereof. It endeavors to discover whether Court decisions reveal an explicit judicial articulation of the bounds of security and liberty.

In many disparate areas Court pronouncements have been rendered, and in practically every instance the substantive power of the federal government has been materially enhanced by liberal judicial interpretations. Separate chapters of this dissertation dealing with property rights, aliens, loyalty, the investigatory power, espionage and

subversion, and the military graphically demonstrate that on no occasion did the Court manifest any inclination to curb the powers of the government on vital questions of security. Judicial pronouncements in specific cases are illustrative of this fact. The Court sustained wartime invasions of property rights, the exclusion and deportation of aliens on security grounds was affirmed, investigations into subversion, and legislation designed to cope with the threat of Communist infiltration were approved by the judiciary, and military tribunals were left relatively free from civil court interference. The Supreme Court has asserted its right to review legislative and executive actions regardless of the gravity of the emergency, and it has continued to scrutinize the administration of national security programs to see that they were in conformity with legislative and executive intent. Procedural irregularities frequently merited judicial censure.

Despite its consideration of numerous controversies the Supreme Court did not formulate a coherent or systematic concept of national security. No discernible judicial philosophy that established the precise delimitations of national security can be extracted from the opinions of the Court. Furthermore, there is no evidence that the Court essayed to provide any substantive content to the amorphous phrase, national security. Several constitutional questions were left judicially unresolved. Although the Court achieved agreement on some basic principles, the justices were unable to arrive at a consensus with respect to the varied problems of internal security. Dissensions on the Court often militated against a uniform expression of views, and apparent uncertainty impeded the development of a synthesis of judicial values regarding national security. A plethora of concurring opinions tended to obscure the trend of constitutional development. There is reason to believe that the Court was not uninfluenced by external non-legal pressures, and a significant correlation between the fluctuations in the threat of totalitarianism and the character of decisions issuing from the Court is apparent.

Microfilm \$3.95; Xerox \$13.75. 305 pages.

MR. JUSTICE HORACE GRAY

(Order No. 61-2970)

Stephen Robert Mitchell, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor David Fellman

This dissertation is a judicial biography of Horace Gray, the Massachusetts judge who served on the United States Supreme Court from 1881 until 1901. The dissertation contains four basic elements, arranged in ten chapters.

The first of these elements is an account of Gray's family background, and the chronicle of events prior to his entrance into public life. An attempt is made to emphasize those factors which influenced his later judicial career.

The second major element deals with Gray's seventeen year career as a state judge, and includes the politics of his appointment as well as an analysis of his contributions to state law. The sources are primarily the more than

seventeen hundred judicial opinions written by Gray during this period. The general conclusion is that Horace Gray was an exceptional state judge who made a number of valuable contributions to Massachusetts law, especially in areas such as the law of property, municipal liability, charitable trusts, and equity. These, and a number of other fields, are analyzed in detail.

A third major element is the account of Gray's long Supreme Court service. Special attention is given the politics of appointment and Gray's relations with his fellow judges. Gray made his most important contributions to constitutional law in the areas of federal-state relations, admiralty, and some of the more specialized areas of law. Each of these areas is fully treated and Gray's role evaluated.

The final element is an assessment of Horace Gray as a Supreme Court Justice, using as criteria standards set up by other judicial biographers. The conclusion here is that while Gray does not belong in the very first rank of our Justices, he deserves a unique place because of some rather unusual contributions to American law.

Microfilm \$4.60; Xerox \$16.20. 357 pages.

AN EXAMINATION OF THE LOGIC OF DEMOCRACY

(Order No. Mic 61-2005)

Thomas Landon Thorson, Ph.D.
Princeton University, 1960

This is an essay in political philosophy. Its major purposes are two: (1) to examine the function of political philosophy in a modern scientific world and to formulate an "analytical" political philosophy which is not incompatible with the methods of science, (2) to formulate a justification for democracy as a procedure for making political decisions. These two purposes are in effect fused into one because of the writer's conviction that political philosophy cannot usefully be discussed in the abstract and that therefore a particular problem must be focussed upon.

The procedure is in large part critical. The approaches of philosophical absolutism and philosophical relativism to the problem of justifying democracy are scrutinized and criticized in considerable detail. This is followed by an examination of the methods of science in large part critical of the understanding of the requirements of science prevalent today in the social sciences. Insights of contemporary philosophers of science are brought to bear on this subject.

After objections to the approaches of philosophical absolutism and philosophical relativism along with a clarification of the requirements of science have been presented, an attempt is made to formulate a standard of legitimacy in politics which comports with the standard of rationality presented by modern analytical philosophy. This standard of legitimacy is then seen to justify and to clarify the principles of political democracy.

After the justification of democracy is presented, an attempt is made to clarify certain selected problems of democratic theory in its terms. These are the question of "limited" v. "unlimited" majority rule and the problem

of the proper function of judicial review in American democratic society.

Microfilm \$4.25; Xerox \$14.85. 330 pages.

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

THE CHANGING ROLES OF AMERICAN UNIVERSITIES IN INTERNATIONAL RELATIONS: A STUDY OF CERTAIN PERCEPTIONS OF UNIVERSITIES' INTERNATIONAL ACTIVITIES AND THE IMPACTS OF SUCH ACTIVITIES ON UNIVERSITIES' PARTICIPATION IN INTERNATIONAL RELATIONS.

(Order No. Mic 61-2677)

Richard Emil Bjork, Ph.D.
Michigan State University, 1961

Major Professor: Edward W. Weldner

American universities have increased markedly all aspects of their participation in international relations. This study focuses primarily on that aspect of universities' participation in international relations for which the university as an institution accepts formal responsibility (referred to in this study as "international programs"), and on the impacts of such international programs on universities' roles in international relations as perceived by a sample of university, government, and foundation personnel. Additionally, the history of American universities' major international activities since 1900 is traced briefly to indicate the significant antecedents of universities' present roles in international relations.

Data for the present study were obtained from interviews and the currently limited amount of literature concerned with the international programs of American universities. A total of 423 persons with international program experiences were interviewed. Of the 423 interviewees, 303 were university personnel, eighty-seven government personnel, and twenty-three foundation personnel. The university personnel were selected from thirty universities involved in international programs at the time interviewing was conducted. Fifty of the government interviewees were working overseas in activities related to universities' international programs at the time they were interviewed. The remaining thirty-seven government personnel were interviewed in Washington, D. C. The twenty-three foundation personnel interviewed were high-level persons in the Ford and Rockefeller Foundations and the Carnegie Corporation of New York. Unguided interviews were used in all instances.

The interview data were organized to explore three groups of hypotheses dealing with the following: (1) the ways university personnel perceived universities' roles in international relations; (2) the perceptions of universities' roles held by foundation and government personnel; (3) with certain aspects of the operational relationships associated with international programs. More specifically,

the interviews attempted to indicate the respondents' perceptions of what international acts universities perform, how universities perform such acts, and why universities perform such acts. The respondents' statements with respect to these hypotheses provided material for an analysis of the impacts of international programs on universities' roles in international relations.

Main Findings

- 1) a. University respondents stated most frequently that universities are expected to perform international acts that are primarily educational in nature. Universities are seldom expected to perform political acts.
- b. Non-university personnel representing foundations and the government stated, by a small margin of frequency, that universities can be expected to perform political acts. The second most frequently stated expectation of this group was that universities are expected to perform educational, cross-cultural, and economic acts. Those respondents emphasizing that political acts can be expected were almost exclusively government personnel, and those emphasizing expectations about other kinds of acts were almost exclusively foundation personnel.
- c. Such stated expectations by all respondents are not wholly in accord with the reported pattern of international programs presently operative. Currently operative programs appear to be primarily in cross-cultural and humanitarian fields.
- 2) a. University and foundation respondents most frequently stated that international programs should be performed primarily through the sending of American faculty and staff abroad, and that such personnel should be abroad within the framework of a university-to-university relationship. Additionally, most university respondents mentioned that universities should have considerable operating independence when operating internationally.
- b. Government respondents most frequently stated that universities' international activities should be more closely related to the government's international activities. Government personnel did not generally appear to support the universities' claim for independence.
- 3) Statements by university respondents as to why universities perform international acts fell with almost equal frequencies into three categories:
 - a. Development of the cooperating country.
 - b. General advancement of knowledge.
 - c. Strengthening of American university.

The frequencies with which universities openly supported "execution of American foreign policy objectives" were very low. This is in contrast to the frequent statements of non-university respondents that universities' international activities are expected to support foreign policy objectives.
- 4) The over-all impact of international programs has been to expand the numbers, kinds, and sizes of the universities' roles in international relations. The

programs' impacts are most evident in the following areas:

- a. Characteristics of university personnel, and university policies toward them.
- b. Subject matters taught and researched by universities.
- c. Internal organization of universities.
- d. International roles of universities.
- e. Some characteristics traditionally associated with the university as an institution.

The expansion and changes of universities' roles have produced considerable confusion and dissension among university personnel. Universities are presently re-organizing and development new forms to meet the increasing demands of international activities on universities' resources.

Microfilm \$4.40; Xerox \$15.55. 342 pages.

THE COMMONWEALTH, COMMUNISM, AND COLONIALISM: A COMPARATIVE STUDY OF COMMONWEALTH FOREIGN POLICIES IN THE UNITED NATIONS.

(Order No. Mic 61-1451)

Edward Collins, Jr., Ph.D.
Emory University, 1959

Director: Charles D. Hounshell

The purpose of this dissertation is to study the Commonwealth as a participant in international politics by making a comparative analysis of the actions of the member states on the political and security questions which have been considered in the General Assembly of the United Nations. It is essentially an attempt to discover the patterns of Commonwealth behavior on these questions, the causes underlying the discovered patterns, and the influence of Commonwealth membership on these patterns.

The documents and official records of the General Assembly of the United Nations were examined to ascertain the Commonwealth's performance on each agenda item referred to the political committees, namely, the First Committee, the Ad Hoc Political Committee, and the Special Political Committee. Also, the question of Palestine, which was considered in the Ad Hoc Committee on the Palestinian Question, and those of Suez and Hungary, neither of which was referred to a committee, were examined.

The records revealed that the Commonwealth was seldom united on any of these questions, and, on those few occasions when it was united, there was no indication that it was because of membership in the Commonwealth. The records further revealed, however, that there was a high degree of cohesion among distinguishable groups of Commonwealth states on certain types of questions. Both the high degree of Commonwealth disunity and the high degree of unity among distinguishable groups of Commonwealth states were most efficiently explained by reference to member-state attitudes towards Communism and colonialism.

The older members of the Commonwealth -- Britain, Australia, Canada, New Zealand, and South Africa --

almost invariably followed anti-Communist policies on cold war questions. Two of the newer members -- Pakistan in 1954 and Malaya in 1957, when it entered the United Nations -- joined the older members in pursuing the course of anti-Communism. The other newer members -- India, Ceylon, and Ghana -- almost invariably sought either to conciliate great Power differences or to refrain from adding to great Power discord. In either case they were more often than not at odds with the other members of the Commonwealth on cold war questions.

Most of the other questions considered by the General Assembly's political committees have concerned the struggle of the peoples of Asia and Africa for independence and equal treatment. The major pattern has been that of a sharp difference between the older and the newer members with a fairly high degree of cohesion among the states in each of these groups. With few exceptions, the newer members have been at the forefront of Afro-Asian efforts to invoke the United Nations in behalf of the peoples of Asia and Africa, and the older members have fairly consistently resisted these efforts.

In the light of the Commonwealth's performance on these questions, it was concluded that the patterns are not so much Commonwealth patterns as they are world patterns: the Western and the Afro-Asian. Those Commonwealth states that have aligned themselves with the West have followed anti-Communist policies, while those members that have not aligned themselves with the West have followed the course of Afro-Asian neutralism. On colonial and related questions, the newer members have been aligned with the Afro-Asian Powers in opposition to Western control over Afro-Asian peoples, while the older members have almost invariably been aligned with the Western colonial Powers.

Microfilm \$4.60; Xerox \$16.20. 358 pages.

WESTERN AND COMMUNIST ATTITUDES TOWARDS CONFLICT: A STUDY IN STRATEGIC THEORY AND PRACTICE.

(Order No. Mic 60-3572)

Alvin James Cottrell, Ph.D.
James Edward Dougherty, Ph.D.
University of Pennsylvania, 1960

Supervisor: Dr. Robert Strausz-Hupé

Western and Communist approaches to conflict in the current global struggle are fundamentally divergent. A study of both strategic theory and concrete historical practice indicates that the concept of "limited war" which has been developed in the West since the Korean War does not mean the same thing to Western and Communist strategists. The notion of limiting war for moral and humanitarian reasons is deep-rooted in Western culture. The revival of the "limited war" idea in the nuclear age represents an effort by many Western strategic writers to resolve the dichotomy of modern Western thought, polarized between total war and absolute pacifism. But in planning and conducting conflict, the Communist strategist normally does not submit to any voluntary limitations of an ethical, spiritual or humane character. Within the limits of action

which are imposed by the laws of physics, geography, economics and psychology, the communist strategist strives to integrate all available modes of conflict in a multi-dimensional scheme.

The communists' concept of total war is quite different from that which has preoccupied the Western mind in the twentieth century. In the West, total war means bringing the maximum amount of physical destructive power to bear upon the enemy to force his unconditional surrender within the shortest possible time. It is intimately related to the traditional Western idea of the decisive military encounter, fought with a frontal strategy. Communist strategists, on the other hand, exhibit a preference for the indirect over the frontal approach. Whenever possible, they avoid provoking open military conflict, waged with conventional armies and methods, and instead rely upon political, psychological, paramilitary and other techniques at which they excel. Their strategy, characterized by a constant shifting of weapons systems and operational tactics, avoids the appearance of decisiveness at any one time and place and prescribes the annihilation of an opponent over a relatively long period of time by piecemeal actions, feints and maneuvers, psychological manipulations and various intermediate forms of violence short of total military war. During the post-World War II period, guerrilla warfare -- which Western governments have found it difficult to counter through conventional military methods -- has figured prominently in communist strategy. Communist strategic writers and practitioners have exerted an important influence upon the development of guerrilla warfare as a means of winning independence against Western colonial rule. All of the operational principles of Communist strategy are designed to exploit the cultural characteristics of Western "open societies." Four of these principles are examined in detail: 1) the indirect approach, 2) deception and distraction, 3) monopoly of the initiative, and 4) attrition. As each operational principle was hypothesized, it was tested by measuring it against the performance record of Communist governments and other Communist instrumentalities in pertinent historical situations.

The divergent Western and Communist attitudes toward conflict confront each other against a background of fast-changing military technology. Although no nuclear war, limited or total, has yet occurred, nuclear weapons have been employed psychologically in one international crisis after another. As critical situations arise, each side seeks to make the last significant move short of outright nuclear war. Such violence as does occur is usually of a marginal character, not sufficient to provoke political leaders into unleashing the instruments of mass destruction. Technological developments have compelled both Soviet and American strategists to alter their traditional security concepts. Soviet strategists recognize the fact that the Russian land mass no longer represents an adequate defense framework in the age of the H-Bomb. American strategists have emphasized the importance of dispersing U. S. retaliatory capabilities through a globe-girdling system of strategic bases. Both the Soviet and the American responses to the challenge of the new military technology have contributed to the growing strategic importance of the underdeveloped areas during the last decade.

Microfilm \$6.85; Xerox \$24.30. 537 pages.

THE ANSCHLUSS: A STUDY OF THE METHODOLOGY OF THE THIRD REICH'S POLICY TOWARD AUSTRIA.

(Order No. Mic 61-2623)

Robert I. Neiman, Ph.D.
New York University, 1958

Adviser: Professor Charles Hodges

The union of Austria with Germany in 1938 represented the culmination of one of the major Nazi objectives. It was achieved by a combination of the techniques and the conventional tools of statecraft used to conduct total political warfare by one state against another.

The desire for union had gradually developed in both countries since the beginning of the nineteenth century. Centuries earlier, migrations by Germanic people to the alpine regions shaped the ethnic composition of the future inhabitants of Austria. Later, dynastic rivalries between that region and the German states characterized relations; however, a common language existed, and a historical and cultural heritage was fostered by membership in the Holy Roman Empire of German Nations. These factors bolstered the growing nationalism inspired by the French Revolution. But rivalry between the ruling houses of the Hapsburgs and the Hohenzollerns prevented the formation of an all-inclusive German nation. Austria's defeat by Prussia in 1866 resolved the issues; Austria was forced out of the German Empire, though sought as a friend and ally.

The union movement came into its own primarily as the aftermath of World War I when the inhabitants of Austria proper faced independence as a truncated state. They clamored for incorporation into the German Republic; the latter cautiously left the way open for a constitutional entry. The Weimar Republic kept a wary eye on France, which opposed any form of union. Austrian endeavors to join as a whole or in part with its sister state politically or even economically were vetoed by the Western Powers. Recourse was eventually sought in the assimilation of the legal systems of the two countries, in order to facilitate a future political merger.

In 1933, with Adolf Hitler in power, the roles were reversed. The Third Reich then aggressively sought an Anschluss; Austria struggled to prevent absorption. The transformation of Germany under the Nazis enhanced Hitler's power as policy-maker and changed the ways and means by which Berlin conducted its policy toward Austria. This consolidation process increased Hitler's grip on the German governmental agencies that carried out foreign policy. As Fuehrer of the NSDAP, he was able to employ his party as an instrument of foreign policy. Germany was also transformed into an armed camp from which military power could force an Anschluss.

The independence of Austria depended on the continued existence of the status quo fostered primarily by France. Hitler's paramount objective was to disrupt the collective security system by enhancing his country's national power. His endeavors went unchallenged by the Western Powers because they were unwilling to fight. The shift of Italy into the German camp completed the undermining of Austria's position.

Despite this gradual shifting of the balance of power in

Europe, making Austria's position precarious, she held out against German efforts to bring Austrian Nazis into power. From 1933 to 1934, the Dollfuss Government withstood unbridled violence by native Nazis, abetted by their German comrades. The unsuccessful Putsch in July, 1934, which ended in the murder of Dollfuss, aroused world opinion. This, and Mussolini's apparent determination to oppose Nazi expansion down the Danube, caused Hitler to reverse his policy of coercion.

Instead of overthrowing the Austrian government by force, first steps were taken to establish a position of effectiveness for German representatives in Austria and to seek political freedom for Austrian Nazis. Second, a policy developed to infiltrate the Austrian government with secret Nazis to prepare for an internal seizure of the Austrian state apparatus. The lever to exhort concessions from Vienna was a treaty negotiated successfully by Franz von Papen in 1936. The Nazi plan was to aid the Austrian Nazis to capture their government; once in control they were to prepare the country for an Anschluss at an appropriate time.

The diplomatic skill of Austrian officials held these concessions to a minimum. The Austrian success was also partly due to Hitler's preoccupation with the West, his rearmament program, and his efforts at a rapprochement with Italy. Additionally, he did not abandon the extremists among the Austrian Nazis. This divided the party and provided the Austrians with an opportunity to exploit the disunity. So, from 1936 to 1938, Schuschnigg was able to prevent the Nazis from achieving their objective.

When it became obvious that no headway was being made, Hitler, with the aid of von Papen and Seyss-Inquart, exacted concessions from Schuschnigg at Berchtesgaden by means of psychological and military pressure. The new terms were designed to further the Austrian Nazis in their subversion of the Austrian government. Hitler also abandoned the extreme Nazis and thus opened the way for party unity.

Although Schuschnigg was able to sabotage the effects of the new agreement, the inevitability of a showdown with Hitler on the Anschluss forced him to challenge German propaganda that union was desired by the majority of the Austrians. He decided on a plebiscite to settle the question of Austrian independence.

Hitler had to meet this decision or have his union policy suffer a serious setback. He decided to block the plebiscite by ordering the Austrian Nazi government officials to oppose the popular vote. While the situation was still fluid, he was persuaded by Goering that there was an opportunity to demand the formation of an Austrian Nazi government. But Hitler's Fifth Column was unable to take over in Vienna. This could not be achieved until German military units actually invaded the country.

The absence of foreign opposition decided Hitler on a further change in policy. He ordered the annexation of Austria, camouflaging the action by calling it a "reunion"; it proved successful.

Microfilm \$5.75; Xerox \$20.50. 451 pages.

THE 1922-23 EXCHANGE OF MINORITIES AND ITS IMPACT UPON GREECE.

(PART I: GREECE RECEIVES THE REFUGEES.
PART II: THE REFUGEES ACCEPT GREECE).

(Order No. Mic 60-5037)

Demetrios Th. Pentzopoulos, Ph.D.
Princeton University, 1959

The existence of national minorities has been the source of some of the most intricate problems in the field of international relations and has often precipitated armed conflicts. In an attempt to safeguard international peace and security, some scholars have advocated, consequently, the obligatory exchange of populations and the transfer of the minorities to the country to which they feel nationally akin. The method was applied for the first time in 1923, when in compliance with the provisions of a Convention signed in Lausanne, Greece and Turkey agreed to a compulsory exchange of their respective Moslem and Christian subjects. This accord, forming a part of the 1923 Treaty of Lausanne, was considered expedient since the decisive victory of Kemal over the Greek army in Anatolia had already caused the flight of most irredentist Greeks from Asia Minor to Europe.

This dissertation attempts to appraise the impact that the influx of a million and a half refugees, constituting one fourth of the total population of Greece, had upon the nation. It is suggested that the newcomers affected every aspect of Greek life:

1. Ethnologically, Greece achieved national homogeneity. The settlement of the Anatolians in the northern provinces of Macedonia and Thrace resulted in the hellenization of those regions and strengthened the position of Greece *vis-a-vis* any revival of the Macedonian question.

2. Economically, the first effects of the exchange were negative, the rehabilitation of the refugees necessitating heavy budgetary expenditures and the contraction of foreign loans, under the auspices of the League of Nations. As the transferred persons recovered from the shock of their transplantation, however, they became a positive element in the development of Greece. Agricultural and industrial output increased, new industries were established, and the progressive and cosmopolitan outlook of the Greeks of Smyrna and Constantinople gave a new impetus to the Greek economy.

3. Politically, the party alignment of the new inhabitants, coupled with the domestic conditions in the country, created a strong liberal force which culminated in the proclamation of the Republic of Greece. Later the continued social dissatisfaction and misery that the exchanged persons experienced was demonstrated by a reinforcement of the extreme left. Many poor urban refugee quarters have become the strongholds of Communism in Greece.

4. Socially, the symbiosis of the autochthonous and new populations has not been easily achieved. The refugee consciousness prevailing among the ranks of the Anatolians, their desire to return to their native land and their Oriental idiosyncracy were the major obstacles to their fully accepting the transfer as a lasting event. They were also subjected to social discrimination which disappeared only after the turbulences of the Second World War.

5. Culturally, the fusion of the European and Asiatic Greek outlooks affected profoundly the literature of the

country, strengthened the position of the demotic language and opened new horizons to Greek thought.

In the light of the Greek-Turkish experiment one may conclude that a transfer of populations creates economic and social structural disequilibria which require a long period of recovery. The method is a radical and drastic "surgical operation" whose effective implementation demands the presence of four prerequisites:

1. The exchange of populations should be effectuated following an agreement of the countries concerned.
2. It should be supervised by an international commission composed of competent and impartial officials.
3. Provisions should be made for the appraisal and liquidation of the abandoned properties and the indemnification of their owners.
4. The international community should assist morally and financially the affected nations in their efforts to resettle the exchanged individuals.

Microfilm \$5.95; Xerox \$21.20. 468 pages.

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

THE CONFLICT OF POLITICAL AND ECONOMIC PRESSURES IN PHILIPPINE ECONOMIC DEVELOPMENT

(Order No. Mic 61-2821)

Harold Edmund Brazil, Ph.D.
The Ohio State University, 1961

The Republic of the Philippines is today experiencing a grave economic crisis which mirrors the nation's long-standing, basic underdevelopment. Since attaining Independence in 1946 the Republic has been unable to establish a broad industrial base, to greatly diversify and increase its products, or to materially improve the inadequate standard of living of the overwhelming majority of its citizens. However, the government is committed in principle to a policy of country-wide economic development, and the people themselves insist that economic development is the most important problem with which the Republic is confronted. Still, no administration has ever been voted in or out of office solely because of its successes or failures in economic development. To be added to this apparent contradiction is the fact that the Republic has, in the National Economic Council, a highly competent and efficient governmental agency which develops comprehensive, apparently well-suited economic development programs, but which remain largely unimplemented and virtually ignored by the government. The results is that the nation's defective economy is maintained, increasing deficits are created by government operations, the expanding population remains impoverished, and the crisis of fiscal stability and economic security is accentuated.

This vicious circle is not necessarily inevitable. The Philippine Archipelago is an agriculturally productive land, rich in natural resources. The Filipino people are capable and resourceful, and possess an intellectual capacity fully adequate to harness the nation's resources to create improved, stable, progressive conditions of living.

Why is it that the government is unable to deal successfully with these vital tasks? One answer lies in the nature of the political forces existing in the Philippines today and the mode of their operation. Certain of these forces appear to be in such deep conflict that they hamstring the programs of the National Economic Council and preclude the establishment of governmental policies for full-scale development. Another answer lies in the nature of the Filipino socio-politico-economic elite, its monopoly, and the type of government which it provides.

The underlying causes are political and social rather than constitutional, personal, or purely economic. This is partially explained by the nature of the distribution of political power in the Republic, which characterizes the political loyalties of its citizens, the local character of Philippine politics, and widespread political and economic exploitation.

An undemocratic feature of the political process is the destitution which procreates vote-selling and gives rise to public indifference toward government operations and frequently to despair. This contributes to the inability of the electorate to hold the various administrations fully accountable for failures in economic development. Public immorality--depicted by extensive venality, graft, favoritism, and inefficiency in the public service--and a chauvinistic concept of economic nationalism, itself a manipulation of the basically beneficial aspects of nationalism, reflect both the effects and the cause of the economic crisis, the serious shortcomings in the democratic system, and the far-reaching consequences of Philippine underdevelopment.

With respect to possible solutions, several areas of action are examined, the foremost of which is the establishment of an effective national educational system. This is logically the best long-range solution. For the foreseeable future, a speed-up and extension of the present trend toward government decentralization--presaging greater political control at local "grass-roots" levels, and the possibility of responsive government administrations that will institute needed economic development programs--provide a persuasive basis for optimism.

Microfilm \$4.25; Xerox \$14.85. 329 pages.

ECONOMIC PLANNING IN THE PHILIPPINES: ECOLOGY, POLITICS AND ADMINISTRATION.

(Order No. Mic 61-2797)

Jose D. Soberano, Ph.D.
University of Michigan, 1961

This study attempts to assess the prospects of the comprehensive planning program of the Philippine government. Specifically, this work tests the proposition that the planning program of the Philippine government may not be carried out on the comprehensive scale legally intended for many years to come. The data are presented in three parts. Part I covers the "Ecology of Comprehensive Planning"; Part II, the "Politics and Administration of Comprehensive Planning"; and Part III, the "Conclusions and Recommendations."

The approach to the study is essentially ecological. The comprehensive planning program is examined in its various aspects: as a function, as a structure, as a body

of practices and as a composite of valuations. Defined in this manner, the program is then tested according to its compatibility, incompatibility, or facilitativeness in terms of relevant ecological factors (i.e., functions, structures, valuations, and practices,) selected according to the following categories: social structures, valuational patterns, communications network, economic foundations, and the general political and administrative systems. Finally, the planning program is studied in detail according to its actual operation and performance from 1935 to the early part of 1960. Explanation of why the planning program performed the way it did is attempted first, from the arrangements found in the detailed analysis of its performance, and second, from the general structural-functional, and valuational patterns set by the general environment.

The study emphasizes the ecological factors for various reasons: (1) a good many observable facts in the actual performance of the planning program cannot be explained by examining the governmental system alone; (2) the planning program is so encompassing that planning is not alone a function of government but also of the various units and structures of Philippine society; (3) the comprehensive planning is a new function of the Philippine government and it is believed, with John M. Gaus, that "there is an explanation of the functions of government in the changes which take place in its environment, changes which coerce us into the use of government as an instrument of public housekeeping and adjustment."

Among the significant conclusions of the study are the following. (1) There is an evident overloading of the governmental structure with the comprehensive planning function. (2) There is a need to decentralize the planning function laterally and vertically in order to ease the pressure upon the governmental structure. Recommendations are made accordingly. (3) The pressure for a strengthened economic and social development program cannot come from the general society but must be self-generated from within the government. It is accordingly recommended that a corps of government executives be trained to generate the pressure for a strengthened economic and social development program. (4) The technical assistance program of the United States in the Philippines will become increasingly significant over the years particularly in helping implement the recommendations made in conclusion number three above.

Microfilm \$6.90; Xerox \$24.55. 542 pages.

**INTERNATIONAL CIVIL SERVICE:
PRINCIPLES AND PROBLEMS, WITH
PARTICULAR REFERENCE TO THE
UNITED NATIONS.**

(Order No. Mic 61-2629)

Tien-Cheng Young, Ph.D.
New York University, 1958

Adviser: Professor Martin B. Dworkis

Based on personal experience as an international civil servant and on his academic training, the writer presents in this study an analytical view, from the standpoint of public administration, of the fundamental principles

underlying the concept of the modern international Civil Service and the problems thereof. Particular reference is made in this study to contemporary thinking and controversies, both in official circles and in the academic world, with respect to the development of the international Civil Service.

This study falls into three parts. The first covers duties, obligations and privileges of international officials. In the second part, selection, classification, remuneration, appointment and separation, which form the basis of international personnel administration, are dealt with. Staff rights, staff-administration relations and staff morale constitute the last part of the work.

The first part deals with the principles of international loyalty, political neutrality, independence and international privileges. The survey of these questions leads to the conclusion that an international civil service can be, and has been, efficiently organized on the basis of these principles. But the problem of how to reconcile international and national loyalties, political neutrality and fundamental freedom, impartiality and personal convictions, independence and external pressure, is the primary concern of the present study. The manifold contradictions inherent in the principle and machinery of an international civil service entail practical difficulties which are closely related to its future development.

The second part of this study analyzes features that are peculiar to international personnel management. The selection of international officials must be made on the basis of efficiency, competence and integrity on the one hand and of representation from as many geographical areas of the world as possible on the other. But the recruitment of staff from different cultural, educational and linguistic backgrounds tends to render the administrative machinery inefficient while to man an international service with personnel from a few homogeneous states would strike at the roots of its international character. Such is the dilemma in which an international civil service is placed and which is studied in this work.

The implementation of the principle of equal pay for equal work depends largely on an adequate post classification system. But because of constant changes in staff requirements, the classification system of an international civil service must provide greater flexibility than that of any national administration. In order to attract first-rate personnel from all countries, the salary scale of the international civil service must be based on the best paid civil and foreign services of the world. But whether an international civil service should adopt a salary scale on so competitive a basis with outside employment as to remove inducement to transfer to other occupations is questionable. The departure from the principle of equal pay for equal work through the separation of local salary scale from the international salary scale and through the interplay of wage policy with that of social policy is also debatable.

As regards the appointment policy, the question of how to arrive at an adequate compromise between the appointments on a career basis and temporary appointments to allow the constant inflow of fresh talent has been one of the main concerns of international administrators and students of public administration. Similarly, the question of internal promotion as against appointments from outside constitutes another aspect of the administrative dilemma.

Security of tenure must go side by side with the safeguards given to the Staff against arbitrary termination.

The institution of political control through the annual questioning and debating of personnel policy and practices by the governing body of each international organization is suggested to counterbalance the widening of the administration's termination powers.

The third part of the study deals with two subjects: the protection of staff rights and the development of staff-administration relations and staff morale. Because of the lack of homogeneity in staff composition and of the absence of a well defined tradition, the development of a high staff

morale in the international civil service is essential for efficient operation of the international service. By and large this can, and has been, successfully done. The bringing together of people from all parts of the world and making them work together for a common ideal is by itself an outstanding achievement in public administration.

The International Civil Service is a new profession. Whatever it will become tomorrow, it is the duty of today's international civil servants to make it work and work more effectively. Microfilm \$4.70; Xerox \$16.45. 365 pages.

PSYCHOLOGY

PSYCHOLOGY, GENERAL

"ATTRACTION-TO-GROUP," AS A FUNCTION OF STYLE OF LEADERSHIP, FOLLOWER PERSONALITY, AND GROUP COMPOSITION.

(Order No. Mic 61-1055)

Burton Lee Backner, Ph.D.
The University of Buffalo, 1961

An investigation of style of leadership, follower personality, and group composition was undertaken. The study analyzed the effects and interactions of these factors on followers' attraction to, and perceptions of, their groups. The hypotheses were derived from Fromm's theory of symbiosis, the psychoanalytic theory of identification in groups, and findings regarding group expectation. They read as follows: 1) After the first meeting of newly formed groups with formal, non-peer leaders, followers will show greater attraction-to-group (a-t-g) when the leader complements their control needs and the members of the group are homogeneous with respect to these control needs, than when the leader fails to complement their control needs and the members of the group are heterogeneous with respect to these needs; 2) Followers will show greater satisfaction with leadership when the leader complements their control needs; 3) For all followers, a-t-g will vary more as a function of whether the leader complements their control needs, than as a function of whether they are in homogeneous or heterogeneous groups; 4) Other variables being held equal, followers in groups with leader-centered leaders will show greater a-t-g and satisfaction than followers in groups with group-centered leaders.

Careful screening of 185 male high school students was carried out, and 12 six-man groups were assembled. Using Schutz's FIRO control scores, four groups were composed of "autocrats," individuals who express control but do not want it from others; four groups were composed of "abdicates," individuals who do not express control but want it from others; and four groups were composed in which half the members were autocrats and half the members abdicates. On the basis of ratings of their personalities, two leader-centered and two group-centered leaders were chosen to play ego-syntonic roles. They received several

hours of training, and then each led three 45 minute group meetings (one autocratic, one abdicate, and one heterogeneous group). They introduced themselves as psychologists and presented a case history for discussion. Observers recorded group interaction, and each session was tape recorded. At the conclusion of the session, Ss filled out a battery of questionnaires.

It was found that after an initial group session: 1) Homogeneous groups with complementary leaders were perceived as more attractive than heterogeneous groups with non-complementary leaders, confirming the initial hypothesis. 2) Abdicate followers tended to be more satisfied and attracted to groups with more directive, leader-centered leaders than autocratic followers, while autocrats tended to react more positively to the less directive, group-centered leadership than did abdicates. This interaction, however, was statistically significant in only one out of the six comparisons made, so that the second hypothesis received only tentative support. 3) Homogeneously composed groups clearly generated more attraction than did heterogeneously composed groups. Thus, results contradicted the third hypothesis. 4) Leader-centered leaders were generally preferred by, and generated more group attraction in members than the group-centered leaders, as predicted in the final hypothesis.

It was felt that the theoretical postulates from which the hypotheses were drawn were generally supported by the findings. It was also suggested that the study was one of the few to successfully demonstrate the effects of leader-follower variables because it concerned itself with the interactions between these factors.

Some of the shortcomings of the experimental design were analyzed, and suggestions for future research in the area were presented.

Microfilm \$2.75; Xerox \$5.80. 117 pages.

**THE EFFECTS OF AVERSIVE STIMULATION
ON CERTAIN CONCEPTUAL ERROR
RESPONSES OF SCHIZOPHRENICS**

(Order No. Mic 61-2076)

Ronald Lee Brown, Ph.D.
Southern Illinois University, 1960

This study was designed to assess the effects of punishment on the conceptual performance of schizophrenics. The task selected provided opportunities for associative (response to remote aspects of the task) and irrelevant (response to stimuli having no task relevance) errors of thinking. In order to provide an incentive for increased task proficiency, a procedure involving administration of intense white noise through earphones for wrong responses was used. The experimental condition began immediately following a wrong response and persisted for a two-second interval. Under the control condition the concept formation task was administered under the usual conditions of psychological testing.

Although previous studies have contributed to an understanding of the role of incentives on the improvement of schizophrenic performance, no attempt has been made to determine their effects on associative error responsiveness. N. Cameron and L. G. Chapman have concluded from these studies, conducted under standard conditions, that schizophrenics show a progressive decrease in the capacity to resist opportunity for associative errors in thinking.

The following hypotheses were tested in the present investigation:

1. Schizophrenics under the usual rapport conditions of psychological testing will show greater susceptibility to associative distraction than will normals under the same conditions.
2. Under punishment conditions schizophrenics will show significantly less susceptibility to associative distraction as compared with schizophrenics under standard rapport conditions.

Ninety-two schizophrenics and 92 normals were tested individually with an intelligence measure and a concept formation task which involved the assignment of words to one of three conceptual categories. Three intelligence levels were constituted for each population on the basis of their vocabulary weighted score. The assignment of subjects from a given IQ level to the experimental or control groups was randomly determined. The data consisted of: (a) total errors, (b) distracter errors, (c) irrelevant errors, and (d) distracter-minus-irrelevant errors. The results were evaluated statistically with a two-factor analysis of variance design for matched groups.

Results of the present study may be summarized as follows:

1. Schizophrenics presented aversive stimulation for wrong responses were able to form concepts at a near "normal" level.
2. Schizophrenics tested under rapport conditions were decidedly inferior to both normals and "punished" schizophrenics.
3. Normals failed to differ significantly as a result of noise and non-noise treatments.

The above results seem to warrant the following conclusions elaborated below:

1. Schizophrenics are able to form concepts at a normal level when provided appropriate incentives. There was no evidence of permanence or irreversibility of cognitive dysfunction in schizophrenia as claimed by the organicists. Similarly, no support was found for a progressive decrease in capacity for resisting opportunities for associative errors of thinking.
2. Normals tend to operate at a near optimal level of conceptual facility under both reinforcing and usual conditions of psychological testing.
3. The present study suggests several implications for further research. There is a need to: (a) evaluate the relative permanence of effects of both positive and negative reinforcers on schizophrenic conceptual behavior, (b) seek more operational descriptions of population samples and (c) study further the effects of reinforcement on the concept formation of schizophrenics with the goal of gaining information for modifying existing therapeutic techniques.

Microfilm \$2.75; Xerox \$3.80. 67 pages.

**PERSONALITY AND ADJUSTMENT
TO ARCTIC ISOLATION**

(Order No. Mic 61-1071)

Robert Peter Cavalier, Ph.D.
Columbia University, 1961

Studies in isolation and human reactions to stress all pointed to the need for continued investigation in the area of personality. It has been shown that different individuals react differently to stress. Moreover as stress is varied, behavior will likewise vary. There was a need to study both aspects of the problem: intensity of stress and personality factors. Are certain personality factors conducive to adjustment at certain intensities of stress? What factors are deterrents to successful adjustment?

The present investigation took both factors into account, and attempted to study the interacting relationship of different personality factors at different intensity levels of Arctic isolation. The criterion measure was the performance of Arctic workers.

The results of psychological tests, given to Arctic employees before assignment to the North, were analyzed in light of the level of isolation at which the men worked. The personality factors studied were intelligence, interests, personal and social adjustment and mechanical aptitude.

There were two levels of isolation, mild and severe. These levels were differentiated on the basis of the remoteness of the Arctic sites, numbers of personnel, communication and transportation facilities, etc. Thirty-six men were studied to determine if there was any relationship between their test results, assignments, and eventual success or failure. A man was defined as successful if his supervisor recommended him for a second tour of Arctic service. Those who were rejected for continued service formed the failure group.

An initial investigation of these relationships indicated that both sympathy and a sense of purpose required further study. An exploratory analysis found that both these factors could be differentiating between failing and successful workers at a severe level of isolation. The results were not conclusive, and the positive findings of the exploratory analysis were tested by a cross-validation study.

The hypotheses were formulated that sympathy and purpose contribute to successful performance at a severe level of Arctic isolation. These hypotheses were tested by a cross-validation experiment in which seventy subjects were employed.

The results of the cross-validation were not conclusive. There was evidence for the fact that sympathy was a positive factor related to success under severe Arctic conditions, but the importance of purpose as a measure of success was not substantiated.

Research has shown that interpersonal relations are very important under conditions of intense isolation with a few other people. Sympathy is regarded by some as an essential process in social relations. The results of the present investigation do lend support to the importance of sympathy in closely circumscribed isolated conditions, where interpersonal strain is felt.

Microfilm \$2.75; Xerox \$4.80. 91 pages.

MODELS FOR THE CLASSIFICATION OF PROBLEMS AND THE PREDICTION OF GROUP PROBLEM-SOLVING FROM INDIVIDUAL RESULTS

(Order No. Mic 61-2686)

James Henry Davis, Ph.D.
Michigan State University, 1961

Major Professor: Frank Restle

Eureka problems (word puzzles having unique solutions), were worked on by individuals, and by ad hoc groups in which unrestricted, face-to-face interaction was permitted between members who had no tradition of working together. The first objective of the study was to introduce an ordering of problems and a method measuring that order. Second, the investigation sought to predict group problem solving performance from a knowledge of the problem solving behavior of persons working as individuals. Major emphasis was placed upon the development of a model that dealt concurrently with group product and emergent group structure. Third, the frequently-noted superiority of problem solving groups over individuals working on the same problems was critically examined.

A model for the distribution of solution times of individual solvers was developed from the idea that the solution of a problem is composed of several steps or stages, and solution occurs upon completion of the k-th stage. Problems can be classified as to the number of stages, which is assessed from the distribution of individual solution times. The Classification Model (statistically a waiting-time model) predicted solution times to be a gamma distribution. The argument proceeded logically to the gamma distribution from such assumptions as that the probability of a stage solution is constant over time until

solution occurs, any one time interval is taken so small that one and only one stage may be solved within it, and the stages are independent and equally difficult.

Two models for predicting group from individual performance were proposed, viz., the Hierarchical and Equalitarian Models. These models predicted the distribution of group solution times to be a simple transformation of the gamma distribution that fitted the individual solution times. The Hierarchical Model assumed that group members organized themselves into a hierarchy with the more successful members consuming more than their share of the group's time. The Equalitarian Model assumed each member took his share of the group's working time, whether he contributed to solution or not.

Data were gathered from individuals working alone and from ad hoc groups of four. These data were: (a) correctness of solution, and (b) the time consumed on each problem. Each group and each individual were tested on a sample problem and three experimental problems, the experimental problems being given in different orders for different subjects. In the groups, not only was solution time recorded, but also a count of the frequency with which each member talked, their choices for future problem-solving partners, observation of member contributions and any unusual events.

The parameter k of the gamma distribution (interpreted as the number of problem stages) was estimated by the method of moments from the sample observations. The theoretical curves thus determined were found to fit the distributions of individual solution times for all three problems. The Equalitarian but not the Hierarchical Model was found to predict the distribution of group solution times in each case. Implicit support for the social psychological assumptions of the Equalitarian Model was found through an analysis of the partner-choice data. The analysis of the communication frequencies of group members, however, was indecisive.

The problem solving behavior of individuals was pooled mathematically and such concocted groups were found to perform significantly better than the real groups on two of the three problems. This finding was interpreted to indicate that member interaction actually inhibited problem solving, at least under the conditions of this investigation.

Microfilm \$2.75; Xerox \$6.60. 138 pages.

THE EFFECT OF SENSORY DEPRIVATION ON DEVELOPMENTAL LEVEL OF PERCEPTUAL ORGANIZATION

(Order No. Mic 61-1058)

Marvin Robert Goldfried, Ph.D.
The University of Buffalo, 1961

The present investigation was designed to study the relationship between sensory deprivation and developmental level of perceptual organization. According to Werner's developmental theory, an important characteristic of early childhood is the lack of any clear-cut distinction between self and environment. This study attempted to induce changes in developmental level of perceptual organization by using a condition of sensory deprivation to simulate a weakening of this ego-environment

distinction in normal adults. The following hypotheses were tested:

- 1a. The initial reaction to the removal of environmental supports by means of sensory deprivation is an attempt to mobilize one's cognitive processes. Thus it was predicted that subjects receiving a short period of sensory deprivation would show an increase in developmental level of perceptual organization.
- 1b. Following the initial increase in the ego's cognitive processes, there will occur a decrement in cognitive functioning; this decrement will be reflected by a lower developmental level of perceptual organization.
- 1c. As the duration of sensory deprivation increases, there will be a further decrease in developmental level of perceptual organization.

2. If a subject maintains tactual contact with the environment when placed in a sensory deprivation condition, there will be less change in developmental level of functioning.

Five experimental groups and one control group each were composed of 12 normal female college students. Three experimental groups were subjected to 15, 30, and 45 minutes of sensory deprivation respectively. The deprivation situation consisted of limiting visual stimulation by means of a completely dark room; tactual stimulation was reduced with gloves and cardboard cuffs, and auditory stimulation by means of a masking sound from an overhead fan. The remaining two experimental groups were subjected to 15 and 45 minutes of deprivation respectively, but subjects in these groups were permitted to maintain tactual contact with their environment by working on finger mazes throughout the period of deprivation.

Level of perceptual organization was measured before and after deprivation for all five groups by a developmental scale of Rorschach Test responses. While two matched sets of five Rorschach cards each were used for the two testings, a control group was employed to determine the effects of practice from the pre- to the posttesting. Subjects in the control group received normal stimulation for a period of 15 minutes between the two testings.

The results of this study were analyzed statistically by means of analysis of variance techniques. None of the predicted differences among groups were found to be statistically significant. As it was noted that the direction and magnitude of change in developmental level was related to the subjects' initial developmental level, analysis of covariance techniques were used to partial out the effect of initial developmental level. Even with these further analyses, however, none of the predicted differences among groups were found to be statistically significant.

Discussion of these findings included the possible effects of individual differences as well as the limited range of the deprivation times. Some suggestions for future research on sensory deprivation involved the variable of individual differences, the sensory modality with which the subject might maintain contact with the environment, and the sensory modality used to assess developmental level. Brief mention also was made as to some future research with the developmental scoring of the Rorschach.

Microfilm \$2.75; Xerox \$4.20. 76 pages.

ORGANIZATION SIZE AND MEMBER PARTICIPATION

(Order No. Mic 61-2759)

Bernard Paul Indik, Ph.D.
University of Michigan, 1961

The aim of this study was to explore and attempt to explain the frequently found negative relationship between the size of an organization and the amount of member participation.

Four alternative explanations were generated within the general supposition that the size of the organization affects the organizational processes, which in turn affect the perceptions and attitudes of the members with reference to the organization, and thereby, the members' participation in the activities of the organization.

Specifically, it was proposed that, as the size of the organization increases, the amount of member participation decreases, at least in part, through the effect of size on the following relational systems. In each case, size has its effects through:

1. Decreasing the average amount of communication that members have with each other and thereby decreasing the amount of attraction these members have to other members of the organizational unit.
2. Increasing the amount of job and task specialization and thereby decreasing the satisfaction the members derive from the activities performed in the organization.
3. Increasing the amount of higher level interpersonal control in the organization and thereby increasing the amount of bureaucratic inflexibility felt by the members.
4. Decreasing the amount of coordination and thereby increasing the amount of bureaucratic inflexibility felt by the members.

The sites used for empirical testing of these schemata consisted of two sets of organizations: (1) thirty-two similarly structured local organizational units of a nationwide business firm, and (2) twenty-eight similarly structured chapters of a national voluntary association. The size of the organizations and the amount of member participation were determined from organizational information. The measures of the mediating variables were developed from questionnaire responses.

An analytic scheme was developed which allowed inferences to be made from correlational information as to whether or not the proposed mediating variables were operating.

The "communication-attraction" linkage between size of organization and the tendency to participate was corroborated by evidence from both organizations. The "specialization-satisfaction" linkage and the "coordination-felt bureaucratic inflexibility" linkage were corroborated by the findings from the business organizations, but not the voluntary organizations. Evidence from both sets of organizations failed to support the "higher level interpersonal control-felt bureaucratic inflexibility" linkage as an explanation. However, there is a revision in this linkage suggested by the results from the industrial organizations. This revision specifies that as size of organization increases and the amount of higher level interpersonal control decreases, the amount of bureaucratic control increases, and the amount of felt bureaucratic inflexibility increases. This would permit another explanation of how size of organization is related to the

tendency to participate. This revised explanation receives some directional support from the findings from the voluntary organizations.

When the three alternative explanations found to be operating in the business organizations are taken as a whole, we find that the entire relationship between organization size and member participation can be explained in terms of the mediating effects of these variables and their interrelationships.

This study has shown that the size of an organization does not inherently determine member participation. This relationship seems to be mediated by sets of variables of the sort explored in this study. The size of the organization does have an impact on such organizational processes as communication, the division of labor, and coordination. These processes, in turn, affect the psychological environment of organizational members in such a way as to bind members into their organizational units.

Microfilm \$2.75; Xerox \$7.20. 154 pages.

**AN ATTEMPT TO DEVELOP MINNESOTA
MULTIPHASIC PERSONALITY INVENTORY
SCALES PREDICTIVE OF ACADEMIC
OVER- AND UNDERACHIEVEMENT**

(Order No. Mic 61-1063)

James Donald McKenzie, Jr., Ph.D.
The University of Buffalo, 1961

A review of the literature indicated that progress has been made in the objective measurement of achievement motivation as a result of the shift from a priori to empirical methods of test construction. Prior attempts to develop Minnesota Multiphasic Personality Inventory scales predictive of achievement were criticized on the grounds that relevant variables were uncontrolled. The purpose of the present research was to attempt to develop scales predictive of achievement, using the MMPI item pool and controlling these variables.

Deviant achievement was defined in terms of discrepancy between measured ability and grade-point average. Only male Ss were employed. Seven scales were developed via the following item analyses: (1) Low ability normal achievers versus overachievers; (2) average ability underachievers versus normal achievers; (3) average ability normal achievers versus overachievers; (4) high ability underachievers versus normal achievers; (5) pooled underachievers versus normal achievers; (6) pooled overachievers versus normal achievers; (7) pooled underachievers versus overachievers. The scales were applied first to the original criterion groups and then to cross-validation groups.

In addition, mean scores of each of the two deviant achievement groups were compared on the MMPI clinical and validity scales with those of the normal achiever group and the other deviant group.

Comparison of groups on these MMPI scales revealed no differences when underachievers were compared with overachievers. When they were separately composed with normal achievers, however, underachievers were found to score higher on Pd and Pt and lower on L and K, while overachievers scored higher on D, Mf and Pt and lower on

Ma. These differences were interpreted as suggesting that both deviant groups are more anxious than normal achievers, with overachievers tending to internalize their anxiety and underachievers tending to externalize their conflicts. The differences between the groups were so small as to indicate that the clinical and validity scales could not be used for predicting an individual's achievement.

Of the seven scales developed empirically, only the one derived by analyzing pooled underachievers versus normal achievers (and subsequently labeled Ua) withstood the test of cross-validation. Possible explanations were offered for the failure of the other scales to "hold up." It was suggested that the MMPI may not constitute the most suitable item pool for differentiating between non-pathologic groups.

While the reliability of Ua was sufficiently high, the overlap between normal achievers and underachievers was too large to warrant using the scale for individual prediction. The mean score of the overachiever group did not differ from that of the normal achiever group. Ua correlated significantly with GPA and zero with an ability measure, combining with the latter to predict GPA slightly better than did the ability measure alone. Ua did not correlate significantly with Gough's Hr scale. The two scales were compared in several regards.

Although the item overlap between Ua and most of the other MMPI scales was not considerable, it correlated significantly with F, Pd, Pt, and Sc positively and with L, K and Hy negatively.

An attempt was made to formulate the psychological nature of Ua. It was suggested that underachievers may be characterized as tending to externalize their conflicts, to be impulsive, and to lack long-range goals and depend for guidance upon the standards of the others. Hostility was seen as playing an important role in the dynamics of this group. Some hypotheses offered by other writers were examined in the light of this interpretation.

Microfilm \$2.75; Xerox \$4.00. 72 pages.

**SOME CORRELATES OF ADJUSTMENT
OF PARAPLEGICS**

(Order No. Mic 61-2664)

Eileen Tressler Nickerson, Ph.D.
Columbia University, 1961

The present study investigated some correlates of adjustment to paraplegia. Paraplegia refers to the paralysis of the lower limbs caused by disease or injury to the spinal cord. Permanent impairment of sexual functioning, bowel and bladder control, and the ability to walk or experience sensation exemplify the frustrating nature of some of the handicaps this condition imposes.

It was hypothesized that the type of person who would adjust constructively to a paraplegic condition would be one who could achieve gratification within the limits imposed by this type of physical immobilization. Such a person would probably be one whose intellectual capacity, education, and social class background has made possible and encouraged an introverted and intellectualized style of living. Specifically, it was hypothesized that adjustment to paraplegia is positively related to: (1) capacity for fantasy,

(2) verbal intelligence, (3) amount of education, (4) socio-economic level, (5) introversive personality traits, and (6) theoretical and aesthetic interests.

The subjects (*Ss*) in this study were 48 male patients from the paraplegic wards of the Bronx Veteran's Administration Hospital, New York. All 48 *Ss* were rated as to their hospital, out-of-hospital, and total adjustment on a nine-point, Q-sort rating scale by four hospital staff judges. The judges were instructed to adhere to a pre-determined set of criteria in making their ratings. Because of the lack of agreement between judges' ratings, two of the four judges' ratings were eliminated on two of the three measures of rated adjustment (i.e., hospital and total).

Four movement threshold scores provided by the Barron ink blots were used as measures of fantasy capacity. Scores received on the Thorndike Vocabulary Test were used as the measure of verbal intelligence. Introversive personality traits were measured by the Thoughtfulness (T) and Restraint (R) scales of the Guilford-Zimmerman Temperament Survey. The Maller and Glazer Interest-Values Inventory furnished measures of theoretical and aesthetic vocational interests. Reports of the patient's educational and occupational status (as well as parental occupation), were used as measures of education and socio-economic status, respectively. Four measures of socio-economic level were utilized; parental occupation alone, parental or patient occupation based on age and length of experience, and patient occupation alone.

The hypotheses that adjustment to paraplegia is positively correlated with amount of education and socio-economic level, except when using parental occupation alone as the measure of socio-economic status, were confirmed. The hypothesis that the theoretical and aesthetic interests are positively correlated with paraplegic adjustment, was confirmed for theoretical interests, and not confirmed for aesthetic interests. The hypotheses that fantasy capacity, verbal intelligence, and introversive personality traits are positively correlated with adjustment to paraplegia were not confirmed, except for Restraint and hospital adjustment.

Some of the hypothesized variables were also significantly interrelated. Various measures of fantasy capacity were positively correlated with verbal intelligence, educational attainment, and theoretic interests. Verbal intelligence was also positively correlated with theoretical interests and with socio-economic status. Socio-economic status, in turn, was also positively correlated with education and theoretical interests. Theoretical interests were correlated positively to the introversive personality characteristics, Thoughtfulness and Restraint, as well as to fantasy capacity and to socio-economic level.

From these results, it appears that the patient who was better able to adjust to a physically immobilizing disability, was the patient who was better able to function in society prior to his disability, as attested to by his relatively higher educational and occupational attainments. Such a patient, as hypothesized, is more motivated by theoretical values.

The intercorrelations between the experimental variables indicate that the patients from a higher educational and socio-economic or occupational level, with higher theoretical interests, tend to be more intelligent, have a greater fantasy capacity, and to be more introverted.

Microfilm \$2.75; Xerox \$7.80. 167 pages.

COGNITIVE BALANCE AND THE RECEIPTION OF UNPLEASANT INFORMATION: AN EXPLORATORY STUDY.

(Order No. Mic 61-2785)

Marc Pilisuk, Ph.D.
University of Michigan, 1961

This study attempted to apply the theory of cognitive balance in attitudes, to those attitudes which are essential to a person's self-esteem. Two extensions to Fritz Heider's theory of balance were used to predict reactions to unpleasant (self-threatening) information.

The original theory of balance predicts several possible outcomes for configurations of attitudes which are not in balanced relationships. The extension defined a group of attitudes on which a person's self-esteem might be said to depend. These attitudes toward aspects of one's self-concept, and toward significant others were considered less vulnerable to change and more likely to be indicative of enduring tension or anxiety when in a non-balanced state.

The first group of hypotheses dealt with relationships among several personality variables the interrelations of which were anticipated by theoretical relationship of each to the concept of central imbalance (that state of attitude imbalance which induces enduring tension). The major hypotheses predicted a positive relationship between self-acceptance and tolerance for ambiguity. A negative relationship was predicted between each of these and a) manifest anxiety and b) inability to tolerate threatening information.

The second set of hypotheses predicted that individuals faced with a negative criticism of an aspect of their self-concepts would handle the criticism in ways which minimized its validity.

The final set of hypotheses was intended to test the hypotheses that central imbalance (in this case, the knowledge that one's intimate friend was criticizing an aspect of one's self-concept) would be met by a series of cognitive operations which would maintain both the valence of the self-concept and the friendship tie, while minimizing the validity of the criticism.

The first set of hypotheses was tested on a population of 154 students tested within the houses of six cooperating fraternities. Standard measures were used to assess anxiety, tolerance for ambiguity and self-acceptance, while specific measures were constructed to assess receptivity to threatening information. The remaining hypotheses were tested in five-person groups. Eighty-eight male subjects met the conditions necessary for the second set of hypotheses. These persons performed a task said to reflect their self-competence and then reacted on questionnaires, to prearranged criticisms, ostensibly from other participants of the group, one of whom was believed to have been highly critical. The final set of hypotheses was tested among 47 experimental subjects participating in the above mentioned groups. For these subjects an intimate friend was identified as having been the negative critic. Reactions were assessed in a way which permitted comparisons with reactions made prior to knowledge of the critic's identity and with reactions by a control group for whom no friend was present.

As predicted, relationships were found between

self-acceptance and tolerance for ambiguity and between each of these and freedom from both anxiety and ability to imagine self-threatening situations. In the laboratory setting, negative criticism, and its anonymous source, tended to be regarded in a wholly negative way with subjects discrediting the criticism with any and all excuses which were made available. Negative criticism from a close friend tended to be first rejected and then reinterpreted with the tendency to view the criticism as a joke frequently noted. Subjects did not alter the positive view of their own behavior and actually increased their estimates of acquaintanceship with the friend. Personality correlates of the various reactions were found.

In conclusion, the results were consistent, with few exceptions, with expectations derived from an extended theory of balance. It is felt that the simple theoretical addition leads to hypotheses important both to personality theory and to an understanding of specific reactions to threat. As such it should merit further investigation.

Microfilm \$2.95; Xerox \$10.35. 227 pages.

**COUNSELING INTERPRETATIONS FOR THE
MINNESOTA VOCATIONAL INTEREST
INVENTORY BASED ON COMPARISONS
WITH THE STRONG VOCATIONAL
INTEREST BLANK**

(Order No. Mic 61-2157)

Thomas Blythe Scott, Jr., Ph.D.
University of Minnesota, 1961

The aims of this exploratory study are (1) to provide normative data on the Minnesota Vocational Interest Inventory (MVII), and (2) to suggest interpretations of similar MVII profiles, based on (a) comparisons with the Strong Vocational Interest Blank (SVIB), and (b) categorizations of selected variables such as age, general ability level, work history, and vocational plans. Normative data from 510 MVII profiles of male counselees (VA hospital vocational counseling service) and 271 male high school seniors, includes the number of times each MVII key is high or low in terms of both relative and absolute elevation.

Inventory comparisons are based on the 244 counselees and 254 students with both inventory profiles. Twenty empirical MVII keys are coded, and profile similarity is judged visually. Subjects with an MVII key high are compared with key-low subjects. Also, similar profile subjects are grouped for comparisons, or similar individuals are grouped via the variables and their MVII profiles compared. Specific types of MVII profiles do not match specific SVIB profiles coded by groups.

Some of the relationships uncovered are: With both food service keys--Bakers, Food Service Managers--high, they relate to a high SVIB farmer key. When at least two of the construction keys--Carpenters, Painters, Plasterers--are high together, this yields profiles agreeing with manifest interests such as work histories. Most of the MVII profile types do agree with manifest and expressed interests. The students' plans are not contaminated by MVII results. The MVII and SVIB carpenter keys show a minimum of agreement. The Painters key relates to SVIB artistic interest keys. The electrical keys--Electricians, Radio-TV Repairmen--relate positively to SVIB

Group II, and to the engineer key in particular. High mechanical keys--Mechanics, Plumbers, Sheet Metal Workers--relate to a high Group IV, high MF, and low IM on the SVIB, and to mechanical-field work histories. The Machinists key relates highly to the MVII electrical keys and to SVIB Group II. Group IV, frequently high for both populations, has higher than usual absolute elevation for mechanical profiles with the Machinists key also high. Both the clerical keys--IBM Operators, Stock Clerks--and the sales keys--Milk Wagon Drivers, Retail Sales Clerks--relate positively to SVIB Groups VIII and IX, and the sales keys alone to Group V. Group X is high more often when the MVII Printers key is high. The two printers keys are not related for absolute elevation, but the SVIB printed key is relatively higher in Group IV when the MVII Printers key is high. A high Warehousemen key is often accompanied by SVIB profiles without primary patterns. The Pressmen and Truck Drivers keys yield no meaningful relationships with the SVIB. The Hospital Aides key relates positively to SVIB Group I, to the chemist key, and to the students' plans and counselees' work histories.

The analysis of the variables, based on frequency counts, points to the electrical keys, the Machinists key, and the Hospital Aides key being high more often for high general ability level subjects. The Warehousemen, Truck Drivers, and food service keys tend toward negative relationships with general ability. Considering age, the electrical keys are high more often for young subjects, the food service keys are preferred more by older subjects. Comparing MVII profiles of those with a specified SVIB group high and low yields results confirming some of the above relationships. For example, high Group II subjects have more electrical profiles than low Group II subjects. Mechanical and electrical profiles are predominant with high MF subjects, non-mechanical profiles with low MF subjects.

Microfilm \$3.90; Xerox \$13.75. 302 pages.

**AN INVESTIGATION OF SUPERVISORY
ATTITUDES IN A UNIONIZED TEXTILE
PLANT AS CONTRASTED TO A
NON-UNIONIZED PLANT**

(Order No. Mic 61-2670)

Emil Van Leeuwen, Ph.D.
Columbia University, 1961

The purpose of this investigation was to study differences in supervisory attitudes of supervisors in a unionized and a non-unionized textile plant.

It was hypothesized that supervisors of unionized wage earners, when confronted with supervisory problems as found in Nelson's Supervisory Practices Inventory, would prefer solutions classified as Group, Individual, Work and Rule oriented in this order of frequency. The supervisors of the non-unionized plant were expected to prefer solutions to supervisory problems in the reverse order. It was further hypothesized that supervisors in the unionized plant would perceive their subordinates by less physical and actional cues and by more characterological and experiential cues when contrasted with supervisors in the non-unionized plant.

The two plants were selected because of their similarity in products, size, same company affiliation, etc. Several

supervisors' background factors were analyzed, compared and found not to differ. The only significant difference found was the fact that one plant had been unionized and the other one had remained non-unionized for over a twenty year period.

In order to test the hypothesized differences in supervisory attitudes, the two groups of first line supervisors, twenty-seven in each plant, completed an adapted form of the Supervisory Practices Inventory. The supervisors were also asked to describe their subordinate group. The latter results were analyzed with the aid of three judges in terms of types of cues used in the descriptions.

The results indicated that the two groups of supervisors differed substantially from each other in terms of their preferred supervisory approach and in the type of content of their subordinate group descriptions. Supervisors in the unionized plant were characterized as having a supervisory approach in which Group, Individual, Work and Rule oriented solutions occurred in that order of preference. The order of preference for supervisors in the non-unionized plant was found to be Work, Individual, Rule and Group oriented solutions. In the type of characteristics supervisors of the unionized plant used to describe their subordinates, Experiential and Characterological categories predominated. For the supervisors of the non-unionized plant Physical and Actional categories occurred most frequently. The two groups of supervisors were found to be significantly different on all measured factors, with the exception of the Individual solution of the Supervisory Practices Inventory.

Further analysis consisted of comparing first level supervisors with higher management in terms of supervisory attitudes. No significant differences were found between the two levels of management. Cross comparisons between plants' supervisors showed that although higher level management had supervisory attitudes similar to their respective first level supervisors, the differences between the two higher levels supervisors were less than those between the first line supervisory groups.

The results suggest that the supervisory attitudes in the unionized plant reflect a motivational type of supervisory approach to subordinates. Evaluation of subordinates appears to take place more in terms of psychological than production characteristics. In the non-unionized plant, the supervisors emphasize production related aspects of supervision; even descriptions of the subordinate group are in terms of work and production related factors. The results further suggest that once a plant becomes unionized, the demands on the supervisors change considerably and previous supervisory patterns or attitudes become inadequate. The findings can also be considered relevant for the purpose of selecting supervisors and for the setting up of appropriate training programs.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

PSYCHOLOGY, CLINICAL

THE RELATIONSHIP OF REPRESSION, PROJECTION AND PREFERENCE IN THE REALM OF HOSTILITY.

(Order No. Mic 61-1505)

Stanley Abrams, Ph.D.
Temple University, 1961

An attempt has been made in this study to demonstrate that subjects who have been rated high in hostility by peers and who are aware of this hostility, will respond to threat in this area by sensitization. That is, they will prefer, project and recall more hostile stimuli than subjects rated high in hostility who do not consider themselves hostile. The latter group was expected to respond by exhibiting repressive tendencies, thus preferring, projecting and recalling fewer hostile symbols than the sensitization group. A third group, composed of subjects who were average in hostility and viewed themselves in this way, were hypothesized to prefer, project and recall fewer hostile stimuli than the sensitizers but more than the repressors. Finally, it was predicted that subjects giving a sensitization or repressive response in one of the measures, would tend to respond in the same direction on all.

The population used in this experiment was composed of 250 student nurses and oral hygienists who used a pair comparison technique to rate themselves and their classmates in regard to the degree of hostility possessed. From these ratings three groups of 20 subjects each were selected for study, namely: those subjects who were highest in hostility and aware of it, those who were highest in hostility but unaware of it, and those who rated themselves as average in this trait and were rated at this level.

In the second phase of this investigation tests were constructed to measure the relative recall and preference of the three experimental groups for hostile and non-hostile symbols. Eight cards composed of four hostile and four non-hostile symbols each were constructed. Each hostile symbol alternated in position with a non-hostile symbol. Four of the cards were used for the recall test and four for the test of preference.

The tests were then administered to all 250 subjects. In the test of recall each card was shown for three seconds after which each subject wrote the names of as many symbols as she could remember. This procedure was used for all four cards. The instructions in the preference test were to choose the two symbols liked the most and the two preferred least. When this was completed the subjects were shown the Rorschach cards and instructed to give three responses to each ink blot.

A chi square test was used to test for significant differences among the three experimental groups. For the functions of preference and recall the results were in the predicted direction, however, significance was found only between the insightful and repressed subjects in the area of preference. A tendency toward significance was also found for this function between the average and repressed groups. For the test of recall nothing approaching significance was attained. The results for projection were only partly in the predicted direction. Although the insightful group projected more hostile symbolism on to the Rorschach than the repressed subjects, both hostile groups gave significantly more hostile responses than those

subjects who were average in hostility. Though statistical significance was attained between the hostile and non-hostile groups, the difference was so small as to preclude individual behavioral prediction.

In an attempt to determine whether individuals respond to hostile stimuli in a constant manner; that is, give a sensitization or repressive response consistently in the functions of recall, projection and preference, a Spearman Rho was computed. In contrast to the hypothesis, the subjects did not respond in a similar manner in the three variables. Although the insightful subjects as a group always responded more to the hostile stimuli than the other groups; because of considerable individual variation no demonstration of constancy was attained. None of the correlations were significant.

Microfilm \$2.75; Xerox \$4.60. 89 pages.

**THE RELATIONSHIP BETWEEN
SUGGESTIBILITY AND FAILURE STRESS IN
NEUROTIC AND NORMAL CHILDREN**

(Order No. Mic 61-2586)

Libero Arcieri, Ph.D.
New York University, 1958

Adviser: Elsa E. Robinson

This study investigated the relationship between suggestibility and anxiety in neurotic and normal children. A total of 108 children of average intelligence selected from two New York City schools were the subjects for the experiment. Fifty-four of the children were, as far as known, of normal emotional adjustment; fifty-four were children whose records showed them to have a chronic pattern of anxiety symptoms and adjustment problems severe enough to lead to their referral to a child guidance clinic. Each group was sub-divided into three year-age groups from 8-9 to 10-11. In the pre-test series the subject was given a suggestibility test which measured the degree to which his drawn reproductions of a series of visual stimulus figures were influenced by a verbal suggestion given before presentation of each member of the series. The two groups were then sub-divided into a success, a failure, and a control sub-group. The success and failure groups, after performing a peg-board task, were told, respectively, that they had done well or poorly. This was followed by a re-administration of the suggestibility test. For the control group the peg-board task was omitted but the suggestibility test was re-administered. Finally, subjective reports regarding changes in "tension," feelings of ego-involvement, and awareness of the influence of suggestion, were obtained for each subject.

The visual reproductions for each subject were rated independently by two judges, according to defined criteria, to determine the degree to which the reproductions had been influenced by suggestion. Agreement between the judges was obtained for 92% of the reproductions, indicating a high reliability of the scoring criteria. Pre- and post-test suggestibility scores were computed for each subject, as well as a difference score between the pre- and the post-series, and an analysis of variance was performed in terms of groups, ages, and conditions. It was found that:

(1) Neurotic children showed a significantly higher degree of suggestibility than normal children at all three age levels on the original and post-tests. (2) Children working under the success condition showed a decline in mean suggestibility score; the difference between mean difference scores of the neurotic and normal groups was not significant. (3) Failure stress did not produce a rise in the mean suggestibility scores of either the neurotic or normal children. (4) The neurotic children who worked under the control condition showed a decline in mean suggestibility score which differed significantly from the rise in suggestibility score of the normal control group. (5) A review of the subjective reports indicated that although the failure experience elicited some degree of ego threat in both groups, at the same time there was some neutralization of anxiety through familiarization with the setting. (6) In view of the inconclusive results regarding the differential effects of success and failure upon suggestibility, modifications of the experimental design were proposed for further research on this problem.

Microfilm \$2.75; Xerox \$5.00. 96 pages.

**CHANGES IN THE VERBAL PRODUCTIONS
OF SCHIZOPHRENICS AS A FUNCTION OF
CHANGES IN ASCRIBED
EXAMINER CHARACTERISTICS**

(Order No. Mic 61-2642)

Siegfried M. Bernd, Ph.D.
New York University, 1961

Adviser: Dr. Edith D. Neimark

Four groups, composed each of twenty male patients between the ages of 23 and 44, who were hospitalized on an admission ward at the V.A. Hospital, Northport, New York, with a diagnosis of acute schizophrenia, were individually introduced in random order to an examiner, with differing instructions regarding examiner identity. The examiner was introduced to one group as a psychiatrist, to the second group as an assistant in the Psychology Department, and to the third and fourth (control) groups with no statement regarding his identity.

Each group was asked to perform the verbal task of making up sentences, using a choice of either "hostile" or "neutral" verbs. The three experimental groups were further subdivided; verbal responses choices of hostile verbs were followed by the word "good" from the examiner for one half of the subjects in each group; the other half were told "good" following the choice of a neutral verb. The control group did not receive these reinforcement conditions. The verbal conditioning followed the standard Taffel procedure of presenting 3 X 5 index cards to the subjects with three pronouns and two verbs typed on them. The operant, acquisition and extinction periods consisted of twenty verb choices each, with verbal reinforcer uttered immediately after the acquisition verb response choices.

The hypothesis tested was that the verbal reinforcer "good" would result in a differential increase in choice of a particular response class of verbal productions, when administered by an examiner who was identified as a physician than when the examiner was not so identified. The

rationale for the study rests upon sociological observations regarding the unique role of a physician in our culture; he is a prestigious figure with benevolent power which operates as a social force on a patient who will have expectations of help and assistance from any physician. Because of these expectations it seems likely that the schizophrenic patient will be more responsive to a physician than to other professional groups and that his approval, within the conditioned verbal response situation, will be a stronger reinforcing agent than that of other individuals.

While the specific hypothesis regarding a differential verbal conditioning effect was not confirmed, it was concluded that there was evidence for the more general argument, that the identification of an examiner as a physician, with a high prestige because of his social role, will influence behavior towards him. The results of the study were: (1) There was a verbal conditioning effect brought about by the verbal reinforcer good under certain conditions; the effect occurred when the verbal reinforcer followed hostile verb response choices and did not occur following neutral verb response choices. (2) There was no differential verbal conditioning effect for the subjects to whom the examiner was introduced as a physician. (3) Regardless of which verb choice was reinforced, the subjects to whom the examiner was introduced as a physician gave more hostile verb responses than those subjects to whom he was not so introduced, when the reinforcement condition subgroups were pooled.

These results were discussed in the light of previous verbal conditioning experiments. The importance of motivational factors, as well as reinforcement factors, in influencing subject-examiner responsiveness, was also discussed. The problem of the meaningful equivalence of verbal response classes was indicated.

Microfilm \$2.75; Xerox \$3.80. 70 pages.

AN EAR FOR AN EYE: THE COMPENSATORY TRANSPOSITION OF SENSORY MODES IN THE BLIND AS A FACTOR IN MAKING JUDGMENTS OF AFFECT.

(Order No. Mic 61-2656)

Sidney Blau, Ph.D.
Columbia University, 1961

This study investigated several phenomena related to the concept of sensory compensation among blind persons as a factor in making judgments of affect. The Ss were 57 congenitally-blind and 66 sighted males and females, 13-19 years old.

By means of a covariance design, sighted Ss were found to be more accurate judges of feelings as the following hypothesis was supported: Controlling for the ability to make correct judgments about everyday sounds, blind persons differ from the sighted in their ability to identify feelings communicated by means of nonverbal, vocal cues. Controlling for differences in mental age, blind and sighted Ss showed no difference in abilities to identify sounds accurately.

Regarding the second hypothesis, the results give no evidence that blind female Ss are superior to blind male Ss in their ability to make correct judgments of feelings

communicated by means of nonverbal, vocal cues. No significant difference was observed among sighted males and females as judges of feelings.

Among the unanticipated findings, it was observed that blind Ss displayed a significantly greater tendency to note affect in spoken dialog, heard via tape recording, as well as a greater tendency to be more specific than sighted Ss in their reporting of tape-recorded sounds. The direction of the results obtained on the two variables was not altered by controlling for mental-age differences. Since correctness was not a criterion on these measures, the results may not be interpreted as indicating greater accuracy among blind Ss in perceiving affect and reporting specific detail.

Studying the confidence with which Ss estimated their own test performance, it was found that for both blind and sighted Ss, a low, positive and significant correlation existed between Ss' abilities to judge feelings correctly and Ss' abilities to estimate their individual performance on the measure. With respect to identifying everyday sounds, sighted Ss revealed a low, positive and significant relationship between their confidence estimates and their abilities to identify sounds. Blind Ss (N = 28) showed a somewhat higher *r* on the relevant scores, but it was not significant.

In only one instance was the sex of Ss found to be related to the results obtained. Blind males were significantly more accurate judges of sounds than blind females.

The results were discussed in terms of the relative needs of sighted and blind Ss for information via auditory channels and the nature of the measures used in this study. Interpreting the conflicting results, a contrast was suggested in terms of the greater degree to which everyday sounds, as compared to verbally-expressed feelings, lend themselves to learning, i.e., in terms of the sounds' greater simplicity, stability, frequency of opportunity, and susceptibility to consensual validation. The implications of the results for educators were explored, and several suggestions offered for future research.

Microfilm \$2.75; Xerox \$5.40. 110 pages.

THE RELATIONSHIP BETWEEN TAT HOSTILITY AND OVERT HOSTILE BEHAVIOR AS A FUNCTION OF SELF REPORTED ANXIETY

(Order No. Mic 61-2657)

Marlin Sydney Brenner, Ph.D.
Columbia University, 1961

The present study investigated the relationship between manifest anxiety and the discrepancy between TAT hostility and overt hostile behavior. A review of prior research and aspects of the theories of Lecky, Freud, and Rogers, suggested that previous inconsistent findings concerning the relationship between fantasy and overt behavior may have been due, in part, to failure in controlling anxiety as a significant variable.

Seventy two high school boys served as subjects. Each wrote six TAT stories which were judged for hostile content, and each was rated by nine peers to determine overt hostile behavior. TAT scores and overt hostile behavior

scores were converted into standard scores, and discrepancy scores obtained by deriving arithmetic differences. Additional data collected information about intelligence, popularity, socio-economic status, preference for physical activity, and self rating of overt hostile behavior.

The Pt scale of the MMPI was used to measure manifest anxiety. Prior research indicated that subjects completing the Pt scale can be divided into three groups: (1) a High Pt Group composed primarily of high anxious subjects, (2) a Middle Pt Group composed of "average" anxious subjects, and (3) a Low Pt Group composed of a mixture of low anxious subjects as well as a group of high anxious subjects who repress or suppress anxiety symptoms.

Two of three major predictions were supported. The discrepancy scores for the High Pt Group were significantly greater than were those for the Middle Pt Group, and the variability of the discrepancy scores for the Low Pt Group was significantly greater than that of the High Pt Group. The third major prediction was unsupported. Discrepancy scores for the Low Pt Group did not differ from those of the Middle Pt Group. The lack of significance may have been due to the wide variability of discrepancy scores in the Low Pt Group. Moreover, the scatterplot of discrepancy scores on Pt approximated the Fisher "Twisted Pear" configuration.

It was concluded that the results support the hypothesis that manifest anxiety is related to the discrepancy between TAT hostility and overt hostile behavior. Post hoc analysis of the data permitted several additional tentative conclusions. TAT hostility was independent of overt hostile behavior, and manifest anxiety was independent of both TAT hostility alone and overt hostile behavior alone. It was also suggested that manifest anxiety was related to discrepancy regardless of the direction of the discrepancy; that is, regardless of whether TAT hostility was greater than overt hostile behavior or the reverse. However, further analysis suggested that the group with overt hostile behavior greater than TAT hostility was more popular and preferred physical activity more than did the group with the direction of discrepancy reversed.

The significance of these findings was discussed with regard to psychological theory, the "Twisted Pear" configuration, research implications, and clinical implications. Emphasis was placed on questions for future research. From among a number of issues raised, two seemed particularly promising. The relationship between fantasy and overt behavior should be investigated thoroughly as a function of additional variables such as anxiety, social class, etc. Also, thorough investigation should be made of the personality differences between groups of subjects as determined by direction of their discrepancy between fantasy and overt behavior.

Microfilm \$2.75; Xerox \$4.40. 85 pages.

CHANGES IN SELF CONCEPT EVALUATIONS AS A FUNCTION OF EXPECTANCY AND EXPERIMENTALLY INDUCED SUCCESS, FAILURE AND NEUTRAL CONDITIONS.

(Order No. Mic 61-2080)

Alvin Irving Cohen, Ph.D.
Southern Illinois University, 1960

This investigation was intended to assess the effects of each of the major variables of expectancy and the experimental conditions of success, failure and neutral information on changes in self-evaluations. An additional aspect concerned investigating the differential effects of the conditions on situations consistent and inconsistent with the subjects' expectancies.

Prior research suggested that the conditions of success and failure would be associated with increases and decreases in self-evaluations, respectively. However, certain theoretical statements indicated that changes in self-evaluations might be greater under each of the conditions if the performance results were not in accord with the subjects' anticipations. These inconsistent situations were assumed to be more threatening than consistent conditions. The major hypotheses were as follows:

(1) Changes in self-evaluations will vary as a function of the experimental conditions, i.e., success will lead to increases in evaluations and failure to decreases in evaluations.

(2) Changes in self-evaluations will vary as a function of expectancy, i.e., the high-expectancy group will change in a negative direction and the low-expectancy group will change in a positive direction.

(3) There will be a significant interaction of the experimental conditions and expectancy, such that the direction of change will be determined by the condition and magnitude of the change by expectancy.

Two experimenters, working independently, were used to collect the data in four sessions on 192 subjects. Column one of the Index of Adjustment and Values was the self measure. Three experimental groups and one control group were employed; the control group receiving the Index only during the four different sessions. During Session I, all of the experimental groups received the self-measure, an expectancy measure, and the task of intelligence, the Wonderlic.

Prior to Session II, the experimental groups were divided into high and low expectancy groups and were then randomly assigned to the three experimental conditions resulting in six groups of subjects each. During Session II, the subjects were given fictitious information concerning their performance on the task and were then given the Index. Difference scores were used and refer to the changes in evaluations from Session II to Session I. Session III and Session IV, the follow-up sessions, followed one day and one week, respectively, after Session II. Analysis of variance was the major statistical technique.

Major hypothesis one was supported; success led to increases in self-evaluation and failure led to decreases in self-evaluation. The results tentatively supported one of the remaining major hypotheses in that the observed order of expectancy by condition mean changes were in complete agreement with the predicted order suggesting that expectancy was a variate. Furthermore, the observation

that in each case the difference between means, while not significant, were in the predicted direction also suggested that expectancy may be a contributing factor. It was concluded that the direction of change was associated with the conditions as predicted. The magnitude was influenced by expectancy but not to the extent that the differences were statistically significant.

An additional major observation was to the effect that changes in evaluations tended to last over the time of this study. It was suggested that perhaps a similar population in a college counseling center might be aided in re-evaluating their self-estimates through the type of information given them and that such changes might last over time.

Microfilm \$2.75; Xerox \$5.20. 103 pages.

A STUDY OF THE EFFECT OF HYPNOTIC SUGGESTION ON COLOR PERCEPTION

(Order No. 61-2902)

Orlando Claude Elsea, Jr., Ph.D.
The University of Oklahoma, 1961

Major Professor: Professor A. F. Glixman

In investigating the effects of central factors upon perception, psychologists have been troubled by the problem of making inferences about the subject's experiential state from his report of that state. One approach to this problem is to use a task which involves an end-organ-determined response and to try to ensure the subject's naivete about what the response should be. Central factors are then manipulated and the subject's reports are examined to see if they change. In accordance with this approach, in four experiments the experimenter has suggested that presence of color stimuli to hypnotized subjects. If the subjects had perceived the suggested colors, they should report the appropriate after-images. Of these four experiments, those of Binet and Frére and of Erickson and Erickson found that color perception was induced by hypnotic suggestion, while Dorcus and Hibler found that it was not.

The present study was designed to test the effect of hypnotic suggestion on color perception and to see whether disagreement among these investigators could be explained. Three variables along which these four experiments differed were considered as likely sources of the discrepancy in results, and were incorporated into the design of the present experiment.

Subjects were volunteers from the Oklahoma State Training School for Girls. They came from lower socio-economic levels, were slightly below average in intelligence, and had normal color vision. Through preliminary screening, 32 deep hypnotic trance subjects were selected to serve as trace subjects. Thirty-two volunteers who were not seen for hypnotic testing were used for the control group.

The effects of three variables were investigated: Length of time spent in trance induction, sophistication of subjects with regard to the negative after-image phenomenon, and chromaticity of the pseudo-stimulus cards. Each of 32 trance subjects were assigned randomly to one of eight treatment groups [2 trance (5-minute trance induction, 30-minute trance induction), 2 sophistication (naive subjects

had no information, sophisticated subjects were given information), and 2 chromaticity (achromatic cards shown in conjunction with color suggestion, chromatic cards shown in conjunction with color suggestion)]. Each of the 32 control subjects was matched randomly with one of the trace subjects with respect to sophistication and chromaticity.

Pseudo-stimulus cards and grey after-image cards were presented alternately to the subjects. Trance subjects were given color suggestions for the pseudo-stimulus cards, while no-trance subjects were instructed only to "look at" the card. Following exposure to each after-image card, the subject was requested to identify its color by selecting one of four matching discs. The results were evaluated by conducting a multiple contingency analysis.

No evidence was found to support the contention that hypnotic suggestion alters color perception at the peripheral level. Neither length of time spent in trance induction, sophistication, nor chromaticity were effective determinants of the subjects' responses.

Microfilm \$2.75; Xerox \$4.80. 91 pages.

THE RELATIONSHIP OF CERTAIN ASPECTS OF THE BODY-IMAGE TO THE PERCEPTION OF THE UPRIGHT

(Order No. Mic 61-2626)

Lawrence Epstein, Ph.D.
New York University, 1958

Adviser: Dr. Harriet B. Linton

The earlier findings of Witkin et al. (39)--that the degree to which one conceives of his body structure as differentiated, integrated, and free from distortion tends to increase with the ability to rely on bodily sensations in determining one's orientation to the upright--has been confirmed by this investigation. In the present study, the ability to use bodily sensations in establishing the upright has also been found to vary in a linear, meaningful fashion with other ways in which the body may be conceived of, or used.

These results tend to affirm and enlarge the meaningfulness of field-dependence as a psychological construct, and they affirm the psychological significance of the body in human experience.

On the other hand, the findings do not support the view that there is a high degree of equivalence among the different aspects which have been subsumed by Schilder under the term, body-image.

Microfilm \$2.75; Xerox \$8.60. 186 pages.

**AN EXPERIMENTAL STUDY OF THE
RELATIONSHIP BETWEEN OVERT BEHAVIOR
AND PERCEPTUAL BEHAVIOR
IN SCHIZOPHRENIA**

(Order No. Mic 61-2631)

Herbert Fensterheim, Ph.D.
New York University, 1958

Adviser: Professor T. N. Jenkins

The purpose of this experiment was to study the relationship between perceptual behavior and overt behavior. The major hypothesis states that "the perceptual behavior of an individual will show the same fundamental characteristics as does his overt social behavior."

Three groups of 25 subjects each were used in this experiment. These groups consisted of a normal control, open ward schizophrenic and closed ward schizophrenic group. All subjects were young adult veterans, drawn from either the patient or staff population of a neuro-psychiatric hospital.

The stimulus material consisted of 12 portrait type photographs of men and 12 of women which were selected to yield a representative sample of impressions.

The experimental tasks were for the subjects to rank the photographs according to five characteristics: intelligence, likeability, temper control, industriousness and happiness. After ranking, the subject divided the stimuli into three categories: above average, average, and below average on the characteristic judged. The orders of characteristics judged and stimulus cards presented were randomized and rotated according to a greco-latin square design. Each subject performed the experimental tasks twice, with a one week interval between sessions.

The results of the experiments showed that the judgements of the normal subjects form two clear cut clusters: an "affective" cluster and an "effective" cluster. The judgements of the open ward schizophrenics showed no such patterning and appeared to be based on a generalization from the "effective" characteristics. The judgements of the closed ward schizophrenics were completely disordered and confused. Similarly, the open ward schizophrenics judged the photographs as being more towards the better end of the continuum than did the normal subjects. This data was interpreted as showing the low self concept of the schizophrenic. Similar data was not obtainable for the closed ward schizophrenic group. It was also found that the normal subjects had the greatest group homogeneity of perceptual behavior and the greatest reliability of judgements over time. The closed ward schizophrenics showed least group homogeneity and least reliability of judgements over time.

It is concluded that perceptual behavior and overt social behavior were shown to possess similar characteristics within the limited areas investigated.

Microfilm \$2.75; Xerox \$6.00. 125 pages.

**A PROJECTIVE TEST STUDY OF
CREATIVITY IN COLLEGE STUDENTS
IN VISUAL ARTS**

(Order No. Mic 61-2748)

Griffith Osler Freed, Ph.D.
University of Michigan, 1961

This study attempted to understand the relationships between certain thought processes and artistic creativity by analysis of the Rorschach and Thematic Apperception Test protocols of thirty-five college art students. The sample consisted of first- and second-year students, selected on the basis of the fact that their teachers judged their works to be highly creative, or uncreative, or of intermediate ability.

The students were also rated on other artistic dimensions, such as Technique, and these dimensions contributed to some of the ancillary findings. The three criterion groups, formed on the basis of their Creativity ratings, consisted of first- and second-year art majors who were generally comparable in age, socio-economic status, intelligence, and social attitudes. Twenty-five of the subjects were females; ten, males.

Current psychoanalytic conceptualizations about the relationships of regressive and adaptive modes of thought to creativity were the bases for the nine major hypotheses. There were six specific subpredictions involving the Rorschach Test, and five involving the Thematic Apperception Test. All were unidirectional predictions about the extreme Creativity groups.

The middle-group results were used in exploratory investigations of the hypotheses in order to determine the presence of relationships between dependent and criterion variables when all three groups are compared. These analyses did not show any significant results, and some reasons for this were considered.

It was found that, as predicted, the high Creative group produced significantly more formal primary-process responses than the low group. With regard to the production of primary-process content, the highs and lows differed as predicted, but only after subjects with less than twenty-five responses were not included in the analyses. Each of these results support the notion that the high Creative students have flexible psychological defenses and regress more readily, that is, use more primitive thought processes, than the low Creative students.

The other four Rorschach hypotheses largely dealt with the adaptive and creative functions of the regressive process. None of the tests of these predictions showed significant differences between the high and low Creativity groups. However, there was a tendency for the more creative subjects to give more creative Rorschach responses. None of the three hypotheses concerning the expression of drive, affects, and bisexual identification were supported by the results, although there was a trend supporting the hypothesis concerning bisexual identification. These hypotheses all deal with measures of drive and/or affect. However, there was evidence that although subjects generally responded to the TAT instructions, they were unable to project their feelings into the stories.

The one result supporting a TAT hypothesis was that which showed that the low group gave significantly more passive, less goal-oriented themes than the high group. This was a measure of adaptive ego-oriented functioning.

Supplementary findings suggest some preliminary explanations for the results and for the directions future research might follow. Thus some of the results indicate that the criteria concerning adaptation and defense might have been made too stringent, particularly with regard to creative art students. In addition, there was some indirect evidence that the teachers conceived of the creativity of the intermediate group in ways different from the high group. These factors and the high relationships found between Creativity and Technique and the other artistic criteria recommend care in future studies with regard to the criteria. Microfilm \$3.55; Xerox \$12.40. 275 pages.

**THE EFFECTS OF INSTITUTIONALIZATION
UPON THE PERSONALITY DEVELOPMENT
OF THE CHILD: AN EVALUATION OF
SELF-CONCEPT AND DEFINITION OF ROLE
IN CHILDREN PLACED IN A
NON-TREATMENT RESIDENTIAL CENTER
AND THEIR RELATIONSHIP TO EARLY
PROLONGED OR RECENT
TEMPORARY INSTITUTIONALIZATION.**

(Order No. Mic 61-2555)

Goldie Leah Kutler, Ph.D.
New York University, 1961

The purpose of this investigation was to evaluate the self-concept and definition of role in a group of children residing at a non-treatment residential center and to explore the relationship of such factors to the time and extent of institutionalization.

To achieve this purpose, three groups each, consisting of fifteen children ranging in age from eight years to thirteen years and of at least average intelligence, were selected; two groups consisted of children drawn from the institutionalized population residing at Hartman-Homecrest, and one group consisted of children drawn from the membership population of the Young Men's and Young Women's Hebrew Association of Williamsburg.

Of the two groups of institutionalized children, one group consisted of youngsters who were placed in an institution within the first three years of life and who had experienced continuous placement in a non-treatment residential center since then. The second group of institutionalized children consisted of children who were placed in a non-treatment residential institution at any time in their lives after the third year and who had spent the first three years of their lives within their own natural family constellations. The third group of children selected from the Young Men's and Young Women's Hebrew Association of Williamsburg never experienced institutionalization in a non-treatment residential center and had a past history of continuous experience within their own natural family milieus. The three groups were equated for chronological age, intelligence, and socioeconomic background.

It was hypothesized that the three groups would be significantly differentiated, one from the other, in the nature of the self-concept. Specifically, the nature of the self-concept of those children who have never experienced institutionalization would reveal a significantly greater degree of self-acceptance, personal adequacy, acceptance

and identification with family and others, and a significantly more mature definition of role than either institutionalized group.

It was further hypothesized that the two groups of institutionalized children would differ from each other in the direction of a significantly weaker self-concept in the group institutionalized early in life.

The children were examined both individually and in small groups by the investigator in the respective settings. The evaluative techniques employed were: the SRA Junior Inventory, the Modified Sacks Sentence Completion Test, the Figure Drawing Test, and the Clinical Interview. The self-concept was evaluated in a global manner as well as in regard to specific variables.

Comparisons made between and among the three groups revealed the following results:

- There was no evidence of any significant differences in self-concept or definition of role between the two groups of institutionalized children. There was partial confirmation of a significant difference in self-concept and role between the recent institutionalized group and the non-institutionalized group. There was a significant trend in the direction of a weaker self-concept in the early institutionalized group as compared to the non-institutionalized group.

- Judgmental evaluations of the global self-concept as expressed on the Modified Sacks Sentence Completion Test and Clinical Interview revealed a significantly greater degree (.05 level of confidence) of self-acceptance in the non-institutionalized group when compared to the recent institutionalized group.

- The recent institutionalized group was more rejecting of the family unit than the other groups. Both groups of institutionalized children were significantly more rejecting of parental figures and of others than the non-institutionalized group.

The following conclusions were made for the research population:

- There is no evidence of any relationship between the time and extent of institutionalization and the development of the self-concept and role definition.

- There is evidence of a relationship between institutionalization and the development of specific aspects of the self, such as identification with the family, parental figures, and others.

Microfilm \$2.75; Xerox \$9.25. 202 pages.

**TIME PERCEPTION, PERSONAL TEMPO
AND ACTIVITY LEVEL IN A GROUP OF
NEUROPSYCHIATRIC PATIENTS**

(Order No. Mic 61-2833)

Edward Bedea Lewis, Ph.D.
The Ohio State University, 1961

The relationship between time perception, personal tempo, and activity level were investigated in a group of recovering neuropsychiatric patients. Estimates of intervals ranging from 7 seconds to 60 seconds were secured by the methods of production and verbal estimation. Considerable individual consistency in time estimation was found, especially when estimates obtained by the same

experimental method were compared. It was predicted that relatively high personal tempo would be associated with relatively short subjective time units and that relatively high activity level would be associated with relatively low error in the estimation of time intervals. The first relationship was supported; the second relationship was not supported.

Responses to a self-report questionnaire on time experience were analyzed to determine what types of responses differentiated personal tempo, activity level, and tendencies toward a slowed or speeded perception of the passage of time. Results of the item analysis indicate that the more vigorous members of the group, i.e., those who were rated as having a relatively fast personal tempo, have a greater interest in and tolerance for planning, more concern with activity and scheduling, and less preoccupation with the past, but do not necessarily project themselves any further into the future than do the less vigorous members of the group. Relatively high activity level, defined in terms of the frequency and variety of transactions with the environment, is associated with a greater concern with the future and a greater degree of optimism in facing the future. Individuals who overestimate the rate at which time is passing apparently feel that time is passing too rapidly to permit desired adjustment or accomplishment.

The hypothesized relationship between rate of reversal of an ambiguously moving visual stimulus (trapezoidal window) and rated personal tempo was not supported. The reversal phenomenon was not significantly correlated with various measures of time perception.

The time estimates did not prove useful in predicting rated status on adjustment. Neither did the items discriminating personal tempo and activity level prove useful in predicting adjustment when those items were combined in a scale. The lack of predictive value of the questionnaire items may be due to the complexity of the criterion.

The linkage of time experience with the motivational and activity life of the recovering mental patient is not simple. It appears that both expressive and defensive functions in fantasy and in activity should be considered in assessing the patient's inclination or disinclination to accept or construct plans for his future.

Microfilm \$2.75; Xerox \$4.40. 83 pages.

REALITY TESTING IN THE THOUGHT PROCESSES OF SCHIZOPHRENICS

(Order No. Mic 61-2834)

Dee Norman Lloyd, Ph.D.
The Ohio State University, 1961

Schilder described thought in terms of phases of thought development, proceeding from affective images and associations in the "preparatory phase" to the unification of reality relevant elements into an integrated and complete thought in the "final phase." Schilder considered schizophrenic thought to be the result of the premature closure of thought, so that associations of the preparatory phase, which in normal thought are subordinated, are expressed as completed thought. Schizophrenics were further described by Schilder as lacking in the use of "correction processes" that integrate relevant elements and subordinate

irrelevant associations, and as not attaining an "awareness of the truth or falsity of a completed thought."

Schilder's concepts of correction processes and truth awareness were related in this study to the concept of reality testing and to Bartlett's concept of the ability to detect agreement and differences in evidence leading to the solution of a problem.

An experimental task, consisting of the recall of a short story over a succession of trials, was employed to investigate the hypothesis that in schizophrenics with thought disorganization, ability to detect points of agreement and difference in evidence does not lead to the correction of subsequent recalls of the story.

Subjects were 20 experimental and 20 control group Veterans Administration Hospital patients who were diagnosed as chronic schizophrenics and 15 experimental and 15 control group hospital employees. Both patient groups and normal groups were matched on age, education level, vocabulary raw score, immediate recall score, and a measure of thought disorganization derived from the deviant responses in the pretest protocols. In addition, the two patient groups were matched on length of hospitalization. There were no significant differences on any of the variables on which these groups were matched. There were also no significant differences between the means of the two experimental groups and the two control groups on education level, vocabulary, and immediate recall. These groups, however, differed significantly on age and the thought disorganization score.

The experimental task was presented to the subjects by means of a tape recorder. Trials were discontinued after 22 correct components of the story were reproduced in correct order, or after 15 trials. Experimental group subjects received a playback of their reproductions on each trial in addition to the original story. For the control group subjects, a waiting period replaced the playback of recall.

The hypotheses were (1) that the difference between the normal experimental and control groups in the mean number of trials to reach successive criteria of recall would increase, reaching a significant difference, the experimental group having the lower means, and (2) that there would be no significant differences between the schizophrenic experimental and control groups in the mean number of trials to reach successive criteria of recall.

The results of the experiment supported the hypotheses. Because of differences between the groups in recall on the first trial and the failure of many of the schizophrenic subjects to learn the story to a level where their performances could be compared directly with those of the two normal groups, however, the results were interpreted with caution.

Two secondary analyses of the data were performed: (1) The combined patient and combined normal groups were compared on the mean number of substitute, added, and displaced components in their recalls. (In general, this analysis supported the findings of previous studies investigating schizophrenic responses to verbal materials). (2) The two experimental and the two control groups were combined to investigate the effect of the independent variable (feedback of recall) on the mean number of substitute, added, and displaced components used by the subjects. No significant differences were found in this analysis.

Microfilm \$2.75; Xerox \$4.80. 94 pages.

**FANTASY PRODUCTIONS OF CHILDREN
WITH A PROGRESSIVELY CRIPPLING
AND FATAL ILLNESS**

(Order No. Mic 61-1080)

Robert Stephen McCully, Ph.D.
Columbia University, 1961

The fantasy productions of a group of children with a progressively crippling and fatal illness (muscular dystrophy) were studied. The purpose of the study was to explore the nature of their fantasy as it might be related to their tragic circumstances. Their fantasy material was compared with the fantasies of children who were crippled but did not face the prospect of early death (poliomyelitis), and with children who had neither condition to face (normal). The subjects were all boys, with an age range of 10 to 14 years.

In brief, it was hypothesized that the dystrophy children would rely more extensively on fantasy than would the other groups, that their fantasy would be more varied and original, that when their fantasies focused on death or disaster it would be less realistically treated, and that the future would be handled evasively whenever it appeared in their fantasies.

The procedure was to present each subject with the same stimulus pictures, and to record the stories given for each picture. Six of the pictures were taken from the Murray Thematic Apperception Test, two were from the Michigan Pictures Series, and two were experimental pictures. The stories were analyzed according to categories which were developed and defined in terms of the hypotheses. Two independent judges analyzed twenty per cent of the materials obtained. Statistical tests were applied to the data to determine the independence of the samples and the significances of the differences among the groups.

When compared with the normal group, it was found that the dystrophy group produced more subjective themes, and stories that were more original and fantastic. The dystrophy group tended to introduce themes of catastrophe, death, and disaster more often than the normal group, and catastrophic events were handled or resolved less realistically. The dystrophy group tended to produce fewer outcomes for their stories and to qualify the endings of their stories more often than the normal group. The outcomes given to their stories were more unrealistic than those of the normal subjects, whether or not the future was considered in the outcomes. The statistical tests indicated that these differences were significant at the .05 level, with the majority being at the .01 level or better.

The polio group produced fantasy material which tended to be much more like that of the normal group, though not invariably so. In a few instances, the polio-fantasy material was statistically different from that of the normal group, and in other instances different from that of the dystrophy group. It was concluded that as far as the fantasy material of the polio group was concerned, the polio group stood in an intermediate position between the other two groups.

The findings were discussed in relation to general theoretical considerations about the developing child and the nature of psychological reactions to death in its broadest sense. Suggestions in regard to planning for these children were made, as well as certain points for future research. Microfilm \$2.75; Xerox \$5.80. 120 pages.

**THE EFFECTIVENESS OF BRIEF
PSYCHOTHERAPY AS A FUNCTION OF
EGO STRENGTH: AN INVESTIGATION
OF THE CONTRIBUTION OF EGO STRENGTH
TO THE EFFECTIVENESS OF BRIEF
PSYCHOTHERAPY IN THE ADJUSTMENT
OF MILDLY DISTURBED JUVENILES IN
OUT-PATIENT ORTHOPSYCHIATRIC CLINICS
AS INDICATED BY
BEHAVIORAL MANIFESTATIONS.**

(Order No. Mic 61-2562)

Jack Israel Novick, Ph.D.
New York University, 1961

This research investigated the relationship between personality ego strength and behavioral changes following durations of ten and twenty therapy sessions with mildly disturbed children.

The subjects were white, male, English-speaking eight-to ten-year-old children who were divided into a high and a low ego strength group, each of twenty-two subjects. The groups were equated in intelligence, socio-economic status, age, and degree of undesirable behavior. Excluded from the study population were those children diagnosed psychotic or of clear organic psychopathology.

The three basic hypotheses of this study are that the rate of behavior change among the subjects will vary, that those patients showing higher initial ego strength are more amenable to treatment, and that a certain minimal level of ego strength is necessary for positive change to result from brief psychotherapy.

Measures of ego strength, before therapy, were obtained through the administration of the Rorschach projective technique and an evaluation of the results with the Rorschach Prognostic Rating Scale. Behavior change was measured by rating the research population on the Behavior Problem Rating Scale at three intervals, prior to beginning of therapy, after ten therapy sessions, and, finally, following twenty therapy sessions.

The results of this study are as follows:

1. No significant variation in behavior following brief psychotherapy of ten sessions' duration was found in either of the experimental groups. Since therapy of ten sessions' duration was not followed by significant behavior change, the three basic hypotheses of this study were not supported for this duration of treatment.

2. After twenty therapy sessions the rate of behavior change did vary. The low ego strength subjects showed insignificant change in their behavior while the high ego strength patients reflected statistically significant decreases in their undesirable behavior. Furthermore, while the high ego strength subjects indicated amenability for behavior change following twenty treatment sessions, the low ego strength subjects indicated lack of such amenability in their remaining essentially unchanged in their behavior. Finally, a certain level of ego strength appeared almost always to predict positive change after twenty therapy sessions, while a certain level of ego strength was found correctly to predict lack of success in most instances.

3. Certain specific items of behavior on the Behavior Problem Rating Scale were shown to change significantly among the high ego strength subjects after twenty therapy sessions, while other individual items of behavior remained unchanged even among the high ego strength

subjects. A rationale was developed to explain these results.

4. No significant differences were found in a comparison of behavior change following individual and group therapy. There was also no significant difference in dropout rate between individual and group psychotherapy. A comparison of the behavior problem changes and dropout rates found among the patients following the therapy administered by each of the three participating therapists did not reveal significant variations beyond chance expectancy.

Microfilm \$2.75; Xerox \$8.20. 177 pages.

ASTHMA AND MATERNAL STIMULI

(Order No. Mic 61-1033)

Freya Weaver Owen, Ph.D.
Stanford University, 1961

The respiratory patterns of twenty asthmatic children were compared with those of twenty control subjects in a study designed to determine whether or not the stimulus of the mother's tape-recorded voice would evoke significant respiratory change in the asthmatic children. The control group consisted of children with chronic organic illnesses other than bronchial asthma who were matched with the asthmatic subjects by sex and age. Pneumographic tracings of each child's respiratory patterns were made during two ten-minute experimental sessions. In each session the subject listened to tape recordings of two voices, that of his own mother and that of the mother of his matched control. In one session each of the voices was heard reading a story non-threatening in content. In the other a story potentially threatening in terms of its theme of mother-child separation was read. The unknown voice always preceded the mother's voice. The order of presentation in terms of story content was randomized among the matched pairs. There were thus four experimental conditions within which the pneumographic tracings of each of the subjects were compared.

The 160 tracings obtained from the forty subjects were scored quantitatively in terms of (1) respiratory rate, (2) mean amplitude of excursion and (3) standard deviation of amplitudes. Difference scores for each parameter of measurement were computed for each subject between the two experimental conditions of each of the ten-minute sessions. A second method of evaluation involved the independent rating by two medical judges of eight qualitative variables in each tracing. Here the tracings were coded so that neither judge could identify subject, session or experimental condition. Ratings assigned by the two judges were scored by a third person and the scores on each variable compared for agreement. Difference scores obtained from the judges' ratings were also used to compare the two groups of subjects. The degree of correspondence between the two types of measures was also assessed.

The experimental subjects were compared with the control subjects as to the amount of change in respiratory pattern which occurred when the unknown voice was replaced by the mother's voice. The asthmatic subjects as a group showed much greater change. Although no significant differences were found in measurements of rate and mean amplitude of excursion, comparison of quantitative

values for variability in amplitude of excursions (unknown vs. mother's voice) between the asthmatic and control subjects yielded a t value of 3.93 ("threatening" story) and a t value of 3.71 ("non-threatening" story) ($p < .01$, df=19). Comparison of the asthmatic and control subjects for degree of qualitative respiratory abnormality (unknown vs. mother's voice) as determined by the scores for the ratings of the medical judges yielded a t value of 3.08 ($p < .01$, df=39).

The specific results obtained may be stated as follows:

- (1) Asthmatic children as contrasted with control subjects, showed increased variability in amplitude of respiration as a result of hearing their mother's voice on tape.
- (2) Asthmatic children as contrasted with control subjects showed more abnormal patterns of respiration as a result of hearing their mother's voice on tape. (As rated by medical judges.)

The changes observed were not a function of story content (threatening vs. non-threatening). Thus all significant differences in respiratory pattern between the asthmatic and control groups could be attributed to a single variable, that of the mother's voice.

Microfilm \$2.75; Xerox \$3.80. 69 pages.

COGNITIVE COMPLEXITY AND THE IMPLICIT PERSONALITY THEORY OF THE JUDGE

(Order No. Mic 61-2789)

Robert Alan Rosenthal, Ph.D.
University of Michigan, 1961

This investigation was concerned with relating aspects of the implicit personality theory of the judge (i.e., the nature, interrelationships, and structure of categories he employs in assessing behavior) to cognitive complexity, a personality dimension reflecting a judge's tendency to differentiate among members of various classes of objects and to employ a multiplicity of personality-relevant categories in describing others.

Two preliminary explorations were undertaken to provide empirical bases for operationalizing these concepts. In the first, four judges rated one hundred "targets" (sets of biographical excerpts) on forty-eight eight-point personality trait scales. Orthogonally rotated factor matrices were derived from each judge's ratings of thirty-eight of the scales. Intrajudge and interjudge comparisons were made between factor matrices based on each judge's ratings of five different-sized samples of targets. Factor matrices of individual judges were found to be replicable if based on ratings of fifty targets. Interjudge differences were observed in the number of factors extracted, the size of the factors, and the average variances of the judges' ratings.

The second exploration was designed to identify variables which might correlate with implicit personality theory. Ninety-four undergraduates were tested on various open-ended and forced-choice complexity and rigidity measures previously associated with aspects of cognitive

organization and interpersonal perception. Other tests were administered to control for the effects of intelligence and verbal fluency. Scores on these measures were inter-correlated and factor-analyzed. A presumably methods-free complexity factor was derived. High-loading variables on this factor were the Thematic Apperception Test Motive and Complexity Indices, Verbal Fluency, and the Barron Complexity Index (a questionnaire measure). Ten each of the highest and lowest scorers on the complexity factor were designated, respectively, "complex" and "simple" judges.

The general hypothesis of the main experiment was that aspects of judges' implicit personality theories, operationalized in terms of parameters of the distributions of judges' rating scale responses, were different for complex and simple judges. The judges' ratings of fifty targets on thirty-six trait scales were intercorrelated and factor-analyzed.

Three hypotheses were formulated concerning the relationship of cognitive complexity to the structural qualities of factor matrices produced by individual judges: that orthogonally rotated factor matrices of simple judges differ from those of complex judges in containing fewer factors, larger dominant factors, and a greater number of high-loading variables which appear on more than one factor. None of these hypotheses were supported in either the predicted direction or its opposite.

It was also hypothesized that complex and simple judges differ in the average variability of their ratings and in the mean ratings of individual traits. The obtained difference in average variability of the two groups, while not significant at the criterion level, was sufficiently large to suggest that complex judges perceived a larger range of individual differences among targets than did simple judges.

Differences in means were obtained for fifteen of the thirty-six traits: complex judges perceived the typical target as significantly more emotionally constricted, suspicious, socially maladjusted, and lacking in inner-directed motivation than did simple judges. In addition, it was found that complex judges rated targets more critically on all scales than did simple judges; complex judges showed significantly greater agreement among themselves about the characteristics of the typical target, suggesting that their ratings are more accurate than ratings by simple judges; and discrepancies between self-ratings and ratings of targets were significantly larger for complex than for simple judges, suggesting that the critical tendency of the complex judges was not due to projection.

These findings were interpreted as indicating that implicit personality theories of complex and simple judges differ inasmuch as they employ substantially different frames of reference in assessing others.

Microfilm \$2.75; Xerox \$7.80. 170 pages.

**CLIENT DEPENDENCY IN RELATION TO
COUNSELOR STYLE AND
INDUCED CLIENT SET**
(Order No. Mic 61-2082)

Ronald Henry Rottshafer, Ph.D.
Southern Illinois University, 1960

The purpose of this investigation was to determine the relationship between client expressions of dependency in

the initial counseling contact and both the counselor's style of counseling and an experimentally induced set in the client. "Client dependency" has been defined by Guerney (1956) as,

. . . the extent to which the client asks the therapist for his opinions, or advice, information, evaluation, instruction, or demonstrates a need for structuring from the therapists. Also, it includes the degree to which the client places responsibility for progress or outcome of counseling on the counselor rather than accepting it himself. (p.27)

The client population was obtained by presenting the Mooney Problem Check List to undergraduate psychology classes. The Check List had an attached page which included both a description of available counseling services and a place for students to indicate a desire for counseling. Subjects who thus showed an interest in counseling were considered both self-referred and well-motivated. The counselors used were either Ph.D.'s or M.A.'s in psychology, guidance, and social work. All were well experienced in counseling. The data for evaluation of client dependency was obtained from tape-recordings of the initial interviews.

Since the general concensus of opinion expressed in various studies was that counselor style could be considered consistent from client to client, the same assumption was made for the present study. Before the experiment began, two initial interviews were collected from each counselor in order to evaluate his style. Two counselor styles were to be identified by use of the Strupp scale (1957). The criterion for a "leading" counselor style was that of sixty-five percent of the responses be of a directing, advising, interpreting nature. The criterion for a "reflective" counselor style was, similarly, that sixty-five percent of the responses be of a reflecting, clarifying, simple acknowledging nature. Clients were then randomly assigned to counselors. Clients also were randomly given both written and oral instructions relative to what they might expect from their counselor. This was the experimenter's method of inducing an expectation of either a reflective counselor or a leading one. No attempt was made to measure or alter the client's private, preconceived expectations based on his own past experiences. It was assumed that these were statistically controlled by random assignment of clients to induced sets.

A two-by-two analysis of variance revealed that proportion of dependent responses to all of the client's statements was not significant for either counselor styles or between induced sets. The interaction factor was significant at the .05 level. However, since the above analysis was based on the assumption that counselor style would be consistent, the data was re-analyzed to determine whether such an assumption was tenable. This scrutiny revealed that the majority of the counselors had been inconsistent in their style, contrary to what has been assumed; the original results, therefore, were rather meaningless. Consequently, the data were re-analyzed by evaluating counselor style in each interview instead of only on the two initial contacts. In this way, a two-by-three analysis of variance was used to evaluate the relationship between the proportion of dependency exhibited, the two induced sets, and three types of counselor style--"High," "Medium," and "Low" amounts of leading responses. The results indicated that both counselor style and client sets had an influence on dependency statements of clients, but slightly

above the .05 level. Consequently, the null hypothesis was rejected at the .06 level instead. The interaction value was not at all significant. The following conclusions were made based on the obtained results:

1. Clients who were counseled by leading, advising, questioning, interpreting, counselor styles exhibited a significantly greater proportion of dependent responses than did clients counseled by reflective, clarifying, and acknowledging counselor styles. This was seen as supporting the position of Rogers regarding client dependency.

2. It was also found that clients who were induced to expect a "leading" counselor style exhibited a significantly greater proportion of dependent responses than did those who were induced to expect a "reflective" counselor style.

3. A combination of a leading counselor style and a leading induced set resulted in the greatest amount of client dependency. The combination of a reflective counselor and a reflective induced set resulted in the least amount of dependency.

4. Clients who were induced to expect one type of counselor but who received the opposite of what they expected did not significantly differ from those who received the style of counseling they were induced to expect. This suggested that dependency cannot be increased or decreased by telling the client one thing while acting the opposite, at least in the first interview.

The need for further research was cited for all of the above areas of this study--counselor style, induced set, client dependency, and counselor consistency.

Microfilm \$2.75; Xerox \$5.60. 115 pages.

AN EXPERIMENTAL STUDY OF THE RELATIONSHIP BETWEEN AGGRESSION AND SATIATION IN NURSERY SCHOOL CHILDREN

(Order No. Mic 60-5927)

Hardis Hargrove Saunders, Ph.D.
Louisiana State University, 1960

Supervisor: Professor Brendan A. Maher

The purpose of this experiment is to determine the relationship between satiation and molar aggressive behavior in a play therapy situation, with nursery school children. Baldwin defines satiation as: "the process of reducing the strength of a need through repetition of the goal activity over and over again." Aggression is defined operationally as socially unacceptable behavior as measured by Body's scale of aggression.

Forty-eight children, the least aggressive and most aggressive from two nursery schools, were observed for aggressive behavior in a free-play situation. They ranged in age from 4 years 0 months to 5 years 11 months. There were two observers for each group. The 20 children having aggressive scores above the mean for their group were selected as subjects for this experiment. Ten were placed in the Satiation Treatment, Group I, while the other ten were placed in the "no treatment" Control Group II. Prior to treatment, the 20 children were given Amen's Anxiety Scale for preschool children and the Stanford-Binet Scale, Form L. Statistical analysis of their scores indicated that the groups were equivalent, prior to treatment, in age, intelligence and aggressiveness and anxiety.

The ten children in Group I were given play therapy, a modified form of David Levy's release therapy, for eight one-half hour play sessions on successive days. The treatment was given in a portable play room which had a one-way vision mirror and 17 concealed mats to which were wired electronic counters. Thus, activity during the play sessions could be tabulated. This was considered one measure of satiation. There was also a tabulation of overt aggressive behavior during treatment. Aggressive acts were considered another measure of satiation.

There were two tables in the play room: one, with toys usable as "utensils" of aggression, the other with "targets" of aggression.

One week after completion of the satiation treatment, Group I was observed again for aggressive behavior in a free play situation by Observer II. They were also re-tested on Amen's Anxiety Scale. Thus, there were pre- and post-treatment scores for aggression and anxiety for Group I. The same procedure was used for Group II, the no treatment group.

The experimental design was based on a 2x2 analysis of variance for pre- and post-treatment scores of Groups I and II on aggression. The value of F was 9.35, significant at the 1% level. Further statistical analysis indicated that all four hypothesis were substantiated. There was satiation of molar aggressive behavior for Group I. However, not only were the aggressive acts during treatment tabulated, but also activity, identifications and fantasy. These processes, according to Bender are normal processes which aid the growth of the ego in the normal child. It is this theory of therapy as an aid to normal growth processes that is emphasized in this study.

Since this experimental design did not allow for control of satiation, it cannot be concluded that changes in aggressive behavior are due to satiation alone. Other processes which may have influenced change were: (1) the therapeutic relationship; (2) identifications, (3) fantasy and (4) anxiety. More research is needed to clarify and isolate relevant and vital processes of ego growth that may take place during play therapy with children.

Microfilm \$2.75; Xerox \$3.80. 70 pages.

COMPLIANCE AND DEFIANCE AS IT RELATED TO ROLE CONFLICT IN WOMEN

(Order No. Mic 61-2794)

Marguerite Anderson Smith, Ph.D.
University of Michigan, 1961

This research was designed to explore the relationship of two personality types, Compliant and Defiant, to manifestations of conflict associated with the exclusive adoption of the expected role of wife and mother. Subjects of the study were 107 entering freshmen women from Monteith College in Wayne State University.

A projective test (The Compliance-Defiance Test) was used to discriminate the two personality types according to characteristics deriving from the psychoanalytic interpretation of the dimension of anality. Hypotheses concerning (1) other personality dimensions related to Compliance-Defiance and (2) role variables (attitudes toward wife and mother and career goals) were tested by two personality tests, the Impulse Expression Scale of Sanford,

Webster and Freedman, and a Figure-Drawing Test adapted from Caligor, and through data from structured interviews and a self-administered questionnaire.

Among personality correlates, Defiance is significantly related to high impulsivity as measured by the Impulse Expression Scale, a masochistic orientation toward the role of wife and mother, non-erotized narcissism-exhibitionism, and a strongly internalized Superego. A zero correlation was obtained between Compliance-Defiance and a measure of intelligence, The Test of Critical Thinking.

Attitudes toward two future roles (career woman and wife and mother) show a relationship of Compliance-Defiance to different goals with respect to future role adaptations. Compliance is related to a preference for early marriage, the perception of college in terms of self-enrichment, and rejection of a career-like campus role (newspaper staff work). Defiance is related to later marriage plans, college seen as preparation for a career, and the acceptance of the campus career role. Many other relationships tested, while not significant, were in the predicted direction with respect to attitudes toward the two roles.

The data were further explored relative to two background variables, social class and having a mother who works. The results of this exploration suggest that these variables have some interacting effects on the choice of specific educational and career goals of the two types of women. This effect is observed in regard to rejection of the traditionally feminine career of school teacher in upwardly-mobile, marginally middle-class Defiant girls, and in regard to plans to pursue a career in addition to the wife and mother role by Defiant girls who are daughters of working mothers.

The research indicates that some degree of relationship exists between the personality characteristics described and the attitudes of the two types of women toward future role adaptations.

Microfilm \$2.75; Xerox \$6.60. 137 pages.

A FACTOR ANALYTIC STUDY OF THE ROSENZWEIG PICTURE-FRUSTRATION STUDY AS A PREDICTOR OF ACADEMIC ACHIEVEMENT

(Order No. Mic 61-1510)

Stanley Keck Smith, Jr., Ph.D.
Temple University, 1960

Purposes

The study has two principal purposes:

1. To attempt to reveal the possible interrelationships existing between scholastic achievement on the one hand and tests of scholastic aptitude and the various scoring categories of the Rosenzweig Picture-Frustration Study on the other. The Rosenzweig Picture-Frustration Study is a "projective" technique suitable for administration to relatively large groups of subjects. In view of the belief that projective techniques elicit not only projection but almost all other conceivable mental mechanisms, the utilization of a projective device in a predictive battery may

result in an increase in the predictive efficiency of the battery.

2. To determine whether a significant relationship existed between the scoring categories of the Rosenzweig Picture-Frustration Study and the point-hour ratio of college students such that a prediction of academic achievement could be made using this measure of personality as a predictor.

Limitations

1. The study was confined to undergraduate students of Temple University. All subjects were full-time day students at the time of testing. The male sample was drawn from the School of Business and Public Administration, the female sample from Teachers College.

2. No assumption was made that a given response to the Rosenzweig Picture-Frustration Study would necessarily correspond to either overt or covert responses of a given individual in a more realistic environmental situation.

3. It is not to be assumed that every possibly relevant test was included in the battery.

4. The only index of scholastic achievement used was the cumulative point-hour ratio.

5. The conclusions concerning the nature and meaning of the identified factors should be limited to the population studied and interpreted cautiously until they are verified by additional cross-validation studies.

Procedure

Two purposive samples were used. One consisted of 150 female students in their junior or senior year of Teachers College, Temple University. The second consisted of 150 male students in their freshman year of the School of Business and Public Administration, Temple University.

Both groups were administered the Rosenzweig Picture-Frustration Study, the Ohio State University Psychological Test, and the Temple University English Test. In addition the female group was administered the High Level Arithmetic Test. The criterion of achievement was the cumulative point-hour ratio.

The scores on the above measures were intercorrelated and the resulting matrices were subjected to factor analysis using Lawley's maximum likelihood method.

Results

The Interrelationships Between the Test and the Criterion

Seven factors were identified, of these four were common to both the female and the male populations, two were found in the female population only, and one was found in the male population only. The factors common to both populations were:

1. A bi-polar factor identified in this study as an "aggressively hostile vs. patiently conforming factor."
2. A factor identified as a "language-facility factor."
3. A factor labelled the "absolving-conforming factor."
4. A factor named the "obstacle-awareness factor."

Those found in one population only were:

5. A factor named the "need-persistent factor" found in the female population.
6. A factor labelled "ego-defensive" found in the male population.
7. A second-order factor identified as a "numerical factor" in the data for the female group.

The only significant relationships to the criterion of point-hour ratio found were those between the criterion and:

1. The vocabulary subtest of the Ohio State University Psychological Test.
2. The reading subtest of the Ohio State University Psychological Test.
3. The Temple University English Test.
4. The High Level Arithmetic Test.

The Relationship Between the Rosenzweig Picture-Frustration Study and the Point-Hour Ratio

Of the seven factors identified, two were intellectual: the "language-facility factor" and the "numerical factor." The remaining five were identified among the data for the Rosenzweig Picture-Frustration Study and are classified as personality factors. The factor loadings of these five factors on the criterion (point-hour ratio), and the correlations of the Rosenzweig scoring categories with the criterion, are not statistically significant. Multiple R's computed for both populations support the conclusion that the Rosenzweig Picture-Frustration Study does not appear to contribute any significant predictive value to the battery. No relationship was found such that a prediction of academic achievement could be made using the Rosenzweig Picture-Frustration Study as a predictor.

Summary

1. Seven factors were identified, of these two were intellectual, five were classified as personality factors.
2. The only significant relationships to the criterion of academic success found included scores on the Ohio State Psychological Test, the Temple University English Test, and the High Level Arithmetic Test.
3. The Rosenzweig Picture-Frustration Study was not related to the criterion of academic success in a way enabling it to be used as a predictor of point-hour ratio.

Microfilm \$2.75; Xerox \$7.20. 152 pages.

PSYCHOLOGY, EXPERIMENTAL

RECOGNITION TIME FOR SYMBOLS IN PERIPHERAL VISION

(Order No. 61-2917)

Albert Edward Bartz, Ph.D.
University of Arizona, 1961

Supervisor: N. R. Bartlett

Many studies concerning the various characteristics of eye movements have been carried out since the end of the nineteenth century. One of these characteristics, the "speed of seeing," has been particularly important in applications in industry, the armed services, driver safety, and other related areas.

It was believed that much previous research was not particularly applicable to field situations, since the type of visual reaction required of the subject did not resemble the actual field situation in terms of complexity and extent of eye movement.

The present research was initiated with two purposes in mind. The purpose of Experiment I was to determine the parameters of the speed of seeing in a complex visual task. The purpose of Experiment II was to isolate and measure the various components of the total response. Using the electrical method for recording eye movements, it was possible to measure the initial latency, the travel time of the eye, and the response time for interpreting the signal.

The apparatus for Experiment I consisted of the peripheral stimuli, tracking task, electronic voice key, timer, and appropriate experimenter's controls. The peripheral stimuli were eleven Burroughs type BD200S Nixie Numerical Indicator tubes, placed six feet on the horizontal plane from the subject at 40, 20, 10, 5, and 2.5 degrees right and left. There also was one tube at center or zero degrees. The subject, with head held rigid by means of a headrest, performed continuous monitoring on the tracking task at the center of the array of lights. At random intervals one of the peripheral signals came on and the subject moved his eyes to the stimulus and verbalized the numeral presented into a microphone which stopped the timer.

The apparatus for Experiment II was the same as before with the addition of electrodes, amplifier, oscilloscope and camera necessary for making records of the eye movements.

Results of Experiment I showed that response time increased as the angle from the center line of regard increased. There was no significant difference between pairs of means for right and left sides, so the data were pooled and a straight line was fitted by the method of least squares. The equation for this relationship was $Y = 66.3 + .599X$ where Y is response time in hundredths of seconds and X is the angle from the center line of regard.

It was also found that response time increased as the number of possible signals increased. Response time was slowest when the subject had to respond to one of eleven signals, as against one of four or one of two in the other two situations.

The results of Experiment II showed that the time required for each of the three components of the response increased as the angle increased. It was expected that the latency (the time before the eyes began moving) and the

actual eye movement would increase as a function of angle. However, the vocalization component (the time required for the subject to make his vocal response after his eyes had reached the signal) also increased with angle. It was believed that this was due to changes in either acuity, accommodation, or the hunting of the eye for an exact fixation.

It was concluded that the results of the present research indicated the response time in a complex visual situation may be much longer than previously believed. Further research was proposed that would yield a mathematical relationship between response time and number of possible stimuli, and research that would explain the exact nature of the vocalization component and its relation to angle.

Microfilm \$2.75; Xerox \$3.80. 70 pages.

PERCEPTUAL PRIMITIVENESS IN CHILDREN AS A FUNCTION OF AGE, INTELLIGENCE AND EXPOSURE TIME.

(Order No. Mic 61-1056)

Donald Martin Bernstein, Ph.D.
The University of Buffalo, 1961

This study investigated the effects of age, intelligence and exposure time on primitiveness of perceptual response in children. Primitiveness of response, a concept common to microgenetic theory, and to Werner's developmental theory, refers either to vague, global responses to stimuli or to responses which stress details to an extent that the total stimulus configuration is distorted. Whole responses are considered more primitive than detail responses. Microgenetic theory states that exposure time and primitiveness of response are inversely related while developmental theory states that age and primitiveness of response are inversely related.

Previous studies support microgenetic theory with respect to adults, but the evidence with respect to children is equivocal. Studies of the relationship between age and primitiveness of response were found to have methodological flaws which rendered their findings inconclusive. Some studies have found an inverse relationship between intelligence and primitiveness of response but these investigations used adults and yielded equivocal results.

In the present investigation ten geometric figures were presented at each of four exposure times, 1/100 sec., 1/50 sec., 1/25 sec., and 1/5 sec., respectively. Thirty 6 year olds, thirty 9 year olds and thirty 12 year olds, all males, served as Ss. Within each age group, Ss were equally divided into bright and average IQ groups.

Subjects were required to choose from among four alternatives the one which looked like the stimulus figure. Two alternatives were primitive representations of the stimulus; one stressed wholistic features; the other stressed details. The third alternative, a control, was dissimilar to the stimulus, and thus incorrect, but was more complex than the stimulus, and thus nonprimitive. The fourth alternative was a reproduction of the stimulus figure.

An analysis of variance of total scores based on Ss responses to the stimuli under differing conditions of exposure indicated that primitiveness of response was

inversely related to exposure time for all experimental groups. This finding supported microgenetic theory. The analyses indicated an inverse relationship between age and primitiveness of response between the 6 year olds and each of the older groups. However, no differences were noted between the 9 and 12 year olds. Thus, developmental theory received partial support.

The hypothesized inverse relationship between intelligence and primitiveness of response received no support. It was suggested that factors related to subject selection may have reduced the likelihood of obtaining significant findings.

The data indicated that the frequency of selection of whole or detail (primitive) responses did not exceed consistently the frequency of incorrect nonprimitive control alternatives for each age group at each exposure time. Consideration of the control alternative necessitated caution in the interpretation of findings which appeared to support developmental theory, since such findings may have been due to differences in the rate of increase of correct (veridical responses) as a direct function of age, rather than to differential primitiveness of nonveridical response choice as a function of age.

Analyses of S's responses supported microgenetic theory and offered partial support for developmental theory, in that the frequency of primitive responses decreased as a function of increasing age and exposure time. The findings with respect to the effects of intelligence again were inconclusive.

Implications for future research included investigation of the effects of intelligence using different procedures for subject selection, and an extension of the present investigation to females and to younger age groups. It was also suggested that the relationship between age and primitiveness of response be studied for the tactual modality.

Microfilm \$2.75; Xerox \$4.40. 81 pages.

SOME EFFECTS OF DRIVE ON THE PERCEIVED INTENSITY OF A STIMULUS

(Order No. Mic 61-2745)

Donald Daniel Dorfman, Ph.D.
University of Michigan, 1961

In this dissertation, a series of studies are reported which test some implications of the hypothesis that drive increases the effective intensity of a stimulus. Specifically, the hypothesis under test is the following: $S' = f_i(D, S)$, where S' is the effective stimulus intensity, D drive, S physical stimulus intensity, and the function a monotonically increasing one. It is further assumed that response strength is determined by effective stimulus intensity, not physical stimulus intensity.

In Part I of the dissertation, some implications of the hypothesis for psychophysical data are derived and tested. In an experiment on the effects of drive on threshold estimates, twelve subjects were asked to reply "yes" or "no" as to whether a given tactual stimulus was perceived, with drive level manipulated by varying the intensity of a sound stimulus paired with the tactual cue. In accordance with the implication derived, increase in sound intensity tended to raise the probability of a subject reporting perception

of the tactual cue. An experiment on the effect of drive on intensity estimates was also conducted in which twenty-four subjects were asked to reply "greater than" or "less than" as to whether a given tactual stimulus seemed greater or less than a second one, with sound intensity being varied in the presence of one of the stimuli. The prediction that sound will increase the perceived intensity of a stimulus paired with it was not confirmed, although introspective reports obtained from a post-test questionnaire were in support of the hypothesis. To account for the above, it was proposed that the effect was minimized because of compensatory tendencies by some subjects, and introspective data were presented to support this conjecture.

In Part II of the dissertation, some implications of the above hypothesis for stimulus generalization are derived and tested. It was predicted that if subjects are trained to respond to a particular physical stimulus intensity under a given drive level, increase in drive will change the location of the generalization curve in the direction of the lesser physical stimulus intensities, and decrease in drive in the direction of the larger stimulus intensities. Fifty-six subjects were divided into four groups, one group trained under low drive and tested under high drive, and a second group trained under high drive and tested under low drive. Within each of the above groups, there existed two sub-groups such that for one group the drive-producing stimulus was a maintained sound, and for the second, an intermittent sound. The training procedure consisted of a modified horse-betting situation in which the subject was to guess whether a given horse would win or lose in a series of races (trials). The response "win" was reinforced to a specified tactual stimulus, and generalization of the "win" response was assessed at tactual intensities about this cue. The predictions were confirmed in that increase in drive changed the location of the generalization curve in the direction of the lesser physical intensities, and decrease in drive, in the direction of the larger. However, an unexpected finding that the training curves differed in location in a like manner requires a cautious interpretation of this test. To account for the above, it was assumed that drive increased the distance between the weaker stimuli proportionately more than the larger, and a derivation employing this assumption produced the desired result. Microfilm \$2.75; Xerox \$3.80. 68 pages.

THE IMPORTANCE OF OPTICAL MOTIONS FOR VISUAL SPACE PERCEPTION IN MAN

(Order No. Mic 61-1094)

John Cameron Hay, Ph.D.
Cornell University, 1961

Certain optical illusions, notably the kinetic depth effect, indicate that human observers make consistent rigid object motion identifications when presented with certain artificial kinds of retinal image motion. This suggests the possibility that under normal optical conditions certain classes of optical motions bear a biunique relationship to the class of rigid object motions, and that human beings are able to make use of this relationship.

Our study investigated the two aspects of this possibility. We first applied the methods of matrix algebra to

the analysis of the mapping of rigid object motions into optical motions, in order to see if this mapping possessed biunique properties of interest. The results of this analysis being positive, we framed an hypothesis, the "inverse projection hypothesis," concerning the ability of human observers to utilize the biunique relationship.

The first part of the study confined itself to two particular kinds of rigid object motion: a) translations of three-dimensional objects, b) translations and rotations of flat surfaces. It was found that the optical motions produced by these types of object motion could be characterized in the first case as "radial optical motions," and in the second case as "projective optical motions." The radial optical motions were then shown to determine uniquely the direction of the object translation, the shape of the object, and the ratio between the magnitude of the translations and the size of the object. The projective optical motions were found to determine semi-uniquely the magnitude of the object rotation and the orientation of the surface; under special conditions, they uniquely determined them.

The second part of the study devoted itself to investigating the ability of human observers to identify the surface rotations and orientations uniquely determined geometrically by a certain type of projective optical motion. The displays employed in this investigation were the moving shadows of rigidly moving objects, such as have been used in studies of the kinetic depth effect. The judgments obtained from the observers under a variety of conditions gave limited support to the view that human beings are able to use the information contained in optical motions.

Microfilm \$3.10; Xerox \$10.80. 240 pages.

DISCRIMINATIVE PROPERTIES OF PUNISHMENT

(Order No. Mic 61-2078)

William Carl Holz, Ph.D.
Southern Illinois University, 1960

Punishment is usually considered to decrease the frequency of the responses to which it is applied, but certain observations suggest that this is not always the case. The present experiment investigated the possibility that punishment might increase response frequency. Punishment was found to increase response frequency when it acquired a discriminative property. This discriminative property was established by associating the presence of punishment with reinforcement and the absence of punishment with extinction.

Pigeons were conditioned to peck a plastic disc. Two experimental conditions were then introduced. Under one condition, responses were punished by an electric shock and simultaneously reinforced with food according to a variable interval schedule. Under the other condition, responses were neither punished nor reinforced. Responding was found to be greater when the responses were punished than when they were not. The presentation of punishment produced greater responding even when the effect of reinforcement was temporarily eliminated.

Another method of investigating the discriminative property of punishment was introduced. A 10 minute interval during which all responses were punished was

inserted into sessions that normally did not provide punishment. The response rate increased during this punishment interval. This increase also demonstrates that the punishment had acquired a discriminative property.

Another interesting result was found when these 10 minute punishment intervals were introduced. Immediately upon the termination of punishment, the response rate abruptly increased. An increase in responding upon the termination of punishment has been observed in other experiments when punishment had suppressed response rate. However, in this experiment, the increase in rate upon the termination of punishment followed a period where punishment had increased, rather than suppressed, response rate.

Two implications are suggested by the finding that punishment can acquire discriminative properties. A stimulus which is usually considered to suppress responding may, under certain conditions, paradoxically increase responding. Furthermore, the discriminative property of punishment may influence the results of experiments investigating punishment. If experiments differentially pair punishment with a particular reinforcement schedule, the resulting response rate may be affected not only by the aversive property of the punishment but also by the discriminative property.

Microfilm \$2.75; Xerox \$4.00. 75 pages.

A CLINICAL APPLICATION OF AN ACCURACY INDICATOR FOR TESTING HEARING

(Order No. Mic 61-2079)

William Keith Ickes, Ph.D.
Southern Illinois University, 1960

Supervisor: C. J. Atkinson, Ph.D.

The main purpose of this investigation was to seek information relative to the clinical effectiveness of a type of perceptual indicator known as an accuracy indicator. An accuracy indicator was incorporated into an experimental auditory testing technique. The experimental technique was compared to a conventional audiometric technique containing a semantic indicator. Both audiometric techniques were administered to two groups of twenty subjects, one a group of vocationally retarded young men and the other a group of university students. A secondary interest of this study was differences in hearing acuity which might exist between the two subject groups.

An accuracy indicator designates the stimulus in some manner other than its magnitude such as identifying the stimulus shape, the special location of the stimulus, or the number of stimuli presented. A semantic indicator is a judgment of stimulus magnitude which is usually made in terms of Yes (a stimulus is present) or No (a stimulus is not present). With a semantic indicator the response itself is the measure of perception where as with the accuracy indicator it is not the response but the accuracy of the response which is the measure of perception.

Tests were administered in a sound treated room with a conventional audiometer which had been modified to allow intensity attenuation to a minus 30 db. Subjects were numbered as they reported for testing. Odd numbered

subjects received the experimental hearing test first and the even numbered subjects received the conventional test first. The experimental test consisted of presenting a pure tone simultaneously with a light flash from one of four light bulbs mounted on a panel. The lights were numbered from one to four. The subject was to state the number of the light that was on when the tone was heard. The presentation of one pure tone with four light flashes constituted one light series. Four such light series were presented at each intensity setting of the audiometer for a particular frequency. Hearing was assumed to be present as long as the subject was able to properly identify the light flash appearing with the pure tone at least three times out of four light series. Attenuation proceeded in 5 db steps for each frequency.

For the conventional audiometer test the subject responded by raising his hand when he thought he heard the tone. The threshold was determined by a descending-ascending method.

The significance of the data was determined by means of an analysis of variance. A 5% level of statistical confidence was established. From the obtained results it was concluded that lower thresholds may be expected by the use of an accuracy indicator than by the use of a semantic indicator. The experimental hearing testing technique as used in this investigation required approximately three times as much time to administer as did the conventional test. This may limit the clinical usefulness of the present employment of an accuracy indicator. The experimental hearing testing technique as used in this investigation appears to have value in testing the hard-to-test subject. The accuracy indicator appears to be equally effective for all frequencies tested.

The vocationally retarded group had significantly more hearing loss than did the university students. This finding was not unexpected since none of the vocationally retarded group had IQ's over 80 and therefore might partially be identified with mentally retarded subjects. The high incidence of hearing loss in a mentally retarded population has been established by other research. There does not appear to be a relationship between the high incidence of hearing loss in the vocationally retarded group and the type of indicator used.

Microfilm \$2.75; Xerox \$5.00. 99 pages.

A STUDY OF COLOR DISCRIMINATION IN ADOLESCENT GROUPS OF DIFFERING MENTAL CAPACITIES

(Order No. Mic 61-2560)

Donald Alex Merachnik, Ph.D.
New York University, 1961

The purpose of this study was to investigate the influence of age, sex and mental capacity upon certain color discriminatory responses in three groups of adolescents.

The findings of the study have bearing upon the results of past studies dealing with age and sex variables in color discrimination. In addition the results relate directly to other research studies regarding qualitative differences between familial and organic mental defectives and their implications for special education.

Reports of past studies dealing with the investigation of the influence of age, sex and mental capacity upon color discrimination have revealed much conflicting data. Some studies report differences based upon age and sex differentiation while others fail to find these differences. Research regarding the responses of mental defectives to color have been primarily concerned with the subjective impressions of observers rather than objective experimentation under controlled conditions.

In this experiment, subjects were presented with a test which was essentially a multiple choice color matching task involving the discrimination of small differences in the saturation of specific wave length. The test utilized a type of neutral density filter which offered equal transmission possibilities to all wave lengths in the visible portion of the spectrum. Under controlled conditions of environmental illumination, the subjects were presented with a color matching task which called for the discrimination of small saturation differences in the colors cyan and yellow.

Subjects were asked to select one test standard from a circular field of seven choices which matched another test standard located in the center of the card. Six color cards were presented in three different trials. A total of eighteen choices were therefore required of each subject.

The adolescent subjects included forty-eight normal public school students, forty-eight institutionalized familial defectives and forty-eight institutionalized organic mental defectives. Each subject was screened in accordance with specific group criteria. Normal subjects were selected on the basis of academic, behavioral and intellectual factors. Subjects comprising the familial and organic groups were chosen in accordance with routine institutionalization procedures and a classification system based upon life history data.

Prior to testing all subjects were screened for normal visual acuity and color vision.

Results of the test were analyzed by the factorial design of the Analysis of Variance technique. Where significant differences were obtained the t test technique was applied to the data.

Results of the test were as follows:

- No experimental evidence was presented which supported the hypotheses that age, sex or type of mental defective influenced the ability to discriminate between small color saturation differences.

- Evidence was presented which supported the hypothesis that normal adolescents discriminate between small color saturation differences with greater accuracy than adolescent mental defectives.

The findings of this study may serve to reinforce the basis for early and lengthy training in all sensory areas for the mental defective. Practice in discrimination, including color areas, should be started early and continued until improved to the point that reading and other academic skills may be developed. The training in sensory areas should emphasize gross differences bearing in mind the difficulty in discrimination between stimuli with minor differences.

The inability to show differences between familial and organic mental defectives in responding to color saturation differences raises the question of whether true perceptual differences exist between these groups. Additional study is necessary to ascertain whether true perceptual differences exist between these groups which might necessitate

a change in educational methods currently being employed in special education classes.

Microfilm \$2.75; Xerox \$8.80. 195 pages.

TRAUMATIC AVOIDANCE LEARNING: THE EXTINCTION OF AN AVOIDANCE RESPONSE BY ELECTRIC SHOCK.

(Order No. Mic 61-2781)

Noel Edwin Paradise, Ph.D.
University of Michigan, 1961

The punishment paradox has posed problems for all behavior theory. The purpose of this thesis was to examine the effects of applying electric shock to the instrumental leg lift during the deacquisition phase of training.

Six dogs were trained to avoid shock by lifting their leg in response to a tone. Shock was discontinued after the animal had made 19 of 20 responses in 2 successive training sessions. The animal continued to receive the conditioned stimulus for another 200 trials, and if the instrumental response persisted, was considered to be resistant to extinction. This group rapidly learned the avoidance response and continued to perform the conditioned leg lift under the ordinary extinction.

Six dogs were trained to avoid shock by lifting their leg in response to a tone in the same fashion as the preceding group. However, after reaching the learning criterion, the animals were punished by electric shock .3 second after the beginning of their leg lift. This point corresponded to minimal heart rate. The .3 second shock group learned the instrumental response quickly and discontinued this response after a few applications of the punishment during the deacquisition phase.

Six dogs were trained to the acquisition criterion of the first two groups. During the deacquisition phase the animals were shocked 4.4 seconds after the beginning of their leg lift at a point in time to correspond with the maximal heart rate. This group learned the avoidance response as quickly as did the first two groups and continued to perform this response despite the application of punishment until the 200 trial deacquisition criterion.

Results were obtained on the .3 second shock and 4.4 second shock groups as to the position of their legs when the punishing shock came on and went off. There were no apparent conclusions to be drawn with respect to this variable.

The findings were discussed in terms of minimal and maximal arousal with the proposal that punishment during minimal stress would result in the suppression of a response and shock during peak stress would culminate in the continuance of the avoidance behavior. It was suggested that heart rate might be available as an index of minimal and peak stress.

Microfilm \$2.75; Xerox \$3.00. 46 pages.

**AN EXPLORATORY STUDY OF
MEDIATIONAL PROCESSES IN VERBAL
BEHAVIOR: AN INVESTIGATION OF
VERBAL MEDIATOR INTERACTION
REFLECTED BY CHANGES IN A FORM
OF THE SEMANTIC DIFFERENTIAL AS
APPLIED TO A THEMATIC
PROJECTIVE TECHNIQUE.**

(Order No. Mic 61-2565)

Bernard Leonard Rashap, Ph.D.
New York University, 1961

This investigation explored the role of mediational processes as reflected in changes in a form of the semantic differential in its application to a thematic projective technique (MAPS Test). Specifically, it investigated the responses to combined stimuli from a knowledge of the individual mediators of several specific stimuli. It addressed itself to the specific problem of whether the stimulus properties of the MAPS cards and figures were significantly different from each other in terms of the separate factors of the semantic differential and whether these stimuli interacted with each other.

Ten subjects were divided into two groups. Group I (Procedure I) rated three figures and three cards separately on the semantic differential during the first session. On succeeding three sessions, subjects placed a figure on a background card, made up a story, and then rated the figure subsequent to the story. The final fifth session duplicated the initial one. Group II (Procedure II) followed the same procedure except that the first session was omitted. In order to determine differences between figures and cards in terms of the separate factors on the differential as well as the significance of various interactions of figures and cards, the data was subjected to a factorial design analysis. Results were as follows:

1. For Group I, the stimulus properties for figures on the A factor differed significantly from each other. No significant differences were noted for E and P factors. None of the cards differed significantly from each other on either Procedure I or Procedure II, nor were there any interacting effects of figures and cards.

2. When summed over all factors, figures and cards exerted approximately influence upon the combined ratings (COMB). For individual factors, the A factor was closer to the initial figure rating than the card rating. Where individual ratings followed the stories, (Procedure II), figure ratings were significantly closer to the combined ratings than the card ratings when distances were summed over all factors. No significant differences were noted between factors.

3. When the congruity principle was applied (Procedure I), and predicted and obtained scores were compared, the principle failed to predict directional changes of mediator interaction. The predominant failures occurred in instances which were particularly facilitative of congruity effects--where both signs of figures and cards were similar and where incredulity was ostensibly absent.

4. Using score reproducibility as the reliability criterion, nearly half of all ratings exceeded the confidence limits established for factor scores. On the whole, figures exhibited greater test-retest changes than cards. No significant differences were noted between factors. Cards and figures which showed a large degree of absolute

differences on test-retest, were also the cards and figures which exhibited the greatest frequency of significant differences. Shifts between initial and final ratings exhibited changes in the positive direction, towards the "good," "potent," and "active" sides of the scale for both figures and cards. The E factor displayed a consistent shift in the positive direction on both figures and cards, while the P and A factors changed towards the negative direction.

It was felt that story mediators were operative in addition to the mediators for figures and cards, and that they influenced the results in some unknown manner.

As a general conclusion to this investigation, it appeared that the type of verbal behavior dealt with involves intricate processes requiring more complex models of mediation for its elucidation before the significance of the present findings can be fully understood.

Microfilm \$3.05; Xerox \$10.60. 233 pages.

**TIME REQUIRED FOR TARGET
DETECTION IN COMPLEX ABSTRACT
VISUAL DISPLAYS**

(Order No. Mic 61-2795)

Stanley Wallace Smith, Ph.D.
University of Michigan, 1961

The purpose of this study was to determine the effects of several display variables on the amount of time (*t*) required for an observer to search for and find a particular object (target) in complex abstract visual displays.

The display variables investigated were (1) the number of non-target objects (pseudo-targets) present in the display and (2) the similarity between target and pseudo-targets in terms of (a) size, (b) contrast, (c) size and contrast combined and (d) shape.

Projected displays consisted of discrete, sharply defined, randomly distributed objects in an otherwise homogeneous field were presented to a group of four observers. The objects were all considerably brighter than the field. All pseudo-targets in a display were identical. The observers' task was to find a particular target as rapidly as possible. Search time (*t*) was recorded separately for each observer.

The equation, $\log t = m \log N + n$, where *m* and *n* are slope and intercept constants respectively, expresses the data quite well for the *N* values used (1, 2, 4, 8, 16, 32, 64, 128, 256, 512, and 1024). *N* is the total number of elements present in the display. The target used in this part of the investigation was a square, and the pseudo-targets were circles of the same contrast and size (area) as the target.

The effects of target-pseudo-target size and contrast differences were investigated using a complete 4×4 (size x contrast) factorial design. The target was a square and the pseudo-targets were circles. *N* was 256. When the contrast of the pseudo-targets was reduced so that the contrast difference between target and pseudo-targets was 0, 25, 42 or 54 per cent of the target contrast, search time decreased correspondingly. The results were essentially the same when the size (area) of the pseudo-targets was reduced to 94, 82, 56 or 42 per cent of the target size. Size difference had a somewhat greater effect on search time than did contrast difference. In every case where the

difference between target and pseudo-targets was in terms of both size and contrast, median search time was shorter than for either difference dimension used alone.

In the third part of this study N was 256 and the pseudo-targets were circles which were the same as the targets in contrast and size (area). The targets used were regular polygons: triangle, square, pentagon and hexagon. Search time increased regularly as the number of sides of the target increased.

Thus, the results of this study show that the variables, N and target-pseudo-target similarity, have strong and regular effects on search time. They also demonstrate the usefulness of a new and unique system for constructing and presenting complex visual displays and a methodology involving a special pay-off scheme and target-no-target procedure. Microfilm \$2.75; Xerox \$3.80. 70 pages.

RESISTANCE TO EXTINCTION FOLLOWING NONDIFFERENTIAL REINFORCEMENT OF IRRELEVANT STIMULI

(Order No. Mic 61-2798)

Sally Edith Sperling, Ph.D.
University of Michigan, 1961

The purposes of this study were to demonstrate that response tendency accrues to nondifferentially reinforced irrelevant stimuli present during acquisition training on another set of stimuli and to assess the strength of this tendency. Five groups of rats were given 80 acquisition trials and one group 40 acquisition trials in a runway using single stimulus presentation. Groups (wnLD) and (LD) were presented with a "light-bulb on" positive - "light-bulb off" negative problem with Wide and Narrow stripes each present with the positive and the negative half of the time for Group (wnLD) and grey present for Group (LD). Groups (WNld,a) and (WN) were presented with a Wide stripe positive - Narrow stripe negative problem with "light-bulb on" and "light-bulb off" each present with the positive and the negative half of the time for Group (WNld,a) and not present for Group (WN). Group (wn) was presented with Wide and Narrow stripes only, each of them was under a 50 per cent partial reinforcement schedule. Group (WNld,b) had the same stimuli as Group (WNld,a) but received only 40 acquisition trials. All Ss then received 16 extinction trials in the presence of Wide stripe alone in the runway. The group Ns were 9, 8, 10, 8, 8, and 8, respectively. All statistical analyses were performed on log reciprocal latency $\times 100$ (log RS).

Mean log RS for Wide trials on the last day of acquisition was not different for the experimental groups. Only Groups (wnLD) and (LD) had reached a performance criterion on their discrimination problem by the end of acquisition.

Group (wnLD) ran faster than Group (LD) during the extinction day. This result indicates that response tendency may be considered to accrue to a nondifferentially reinforced irrelevant stimulus during acquisition training in a complex stimulus situation. The strength of the response tendency was assessed by comparing Group (wnLD)'s extinction performance with that of Groups (wn) and (WN) since the data obtained for these two groups

demonstrated that the partial reinforcement effect could be extended to a two-stimulus situation where the stimulus presented during extinction had been one of two 50 per cent partially reinforced stimuli for the first of these groups and had been the positive discriminanda in a simple discrimination situation for the second group. Groups (wnLD) and (wn) did not differ in mean log RS or in amount of log RS decrease from last acquisition day to extinction day, and Group (wnLD) showed less decrease than Group (WN). These results indicate that the strength of the response tendency established under nondifferential reinforcement of irrelevant stimuli may be equivalent to that established under a 50 per cent partial reinforcement schedule.

Group (WNld,a) did not differ from either Group (wnLD) or Group (wn) and showed less decrease than Group (WN). This group showed more resistance to extinction than could be explained in terms of analyses of the absolute stimulus components, stimulus patterns, or a combination of the two that were present during acquisition training. It was suggested that the increased resistance to extinction of this group may be due to some form of generalization of their partial reinforcement history into the extinction situation. Group (WNld,b) did not differ from this group, indicating that the training conditions for Group (WNld,a) did not lead to overtraining.

It was suggested that a re-evaluation of Lawrence's hypothesis regarding the acquired distinctiveness of cues is appropriate in the light of these data since it has been demonstrated that nondifferentially reinforced irrelevant stimuli do not come to be ignored during complex stimulus training. Microfilm \$2.75; Xerox \$4.20. 78 pages.

THE PSYCHOLOGICAL REFRACTORY PERIOD: DISPARATE STIMULI AND RESPONSES.

(Order No. Mic 61-2855)

Melvin James Warrick, Ph.D.
The Ohio State University, 1961

Psychological refractoriness is typically manifest in situations in which a subject must make discrete responses to each of two stimuli presented in rapid succession. If the second stimulus is presented very quickly after the first, the response to the second stimulus is often delayed in excess of its normal reaction latency. This suggests that following a first stimulus, or the response to it, the organism is temporarily unresponsive to a second stimulus. This, in turn, implies that performance is intermittent, the period of intermittency being determined by the duration of the refractory period.

Three related experiments are reported.

In one major experiment a visual stimulus was followed, after a brief interval, by an auditory stimulus. The subjects were required to make a discrete ungraded response to the visual stimulus with one hand and to the auditory stimulus with the other. The stimuli were always presented in the same order - visual then auditory. The interval between the two stimuli ranged from fifty to five-hundred milliseconds. It was found that the shorter the interstimulus interval, the longer the reaction time to the second stimulus. At the fifty millisecond interval, the reaction time to the second stimulus was approximately

two-hundred and forty-five milliseconds, an excess of about eighty milliseconds over the normal reaction time. Some suggestion of refractoriness was still apparent at intervals of four-hundred milliseconds.

Various explanatory models in which it is assumed that the organism becomes temporarily "refractory" following a first stimulus, or its response, were unsuccessfully applied to the data. However, it was noted that the relation between the observed reaction time (Y) to the second stimulus and the interstimulus interval (X) can be approximated by a curve of the general form $Y = a + be^{-cx}$. This suggests that, following the first stimulus, readiness to respond to a second stimulus builds up in a manner analogous to that of "limited growth." On this basis it is hypothesized that the organism is "refractory" prior to receipt of the first stimulus rather than following it, as is usually assumed.

The data also indicated that the latency of responding to the second stimulus was influenced by the order of responding, right-hand then left-hand or vice versa. Furthermore the latency of responding to the second stimulus appeared to depend on whether the second stimulus preceded or followed the first response. These observations suggest that, in addition to being a function of the interstimulus interval, the latency of responding to a second stimulus depends on the nature of the prior response and on its time of occurrence.

In designing the basic experiment, it was considered desirable to minimize the possibility of the onsets of two successive stimuli appearing to occur simultaneously. To determine the minimum interstimulus interval that could safely be used, a psychophysical experiment was performed to determine the threshold of the detectable interstimulus interval and the indifference point. The data indicated that the indifference point, where the subjects were as likely to report that the onset of a visual stimulus preceded the onset of an auditory stimulus as that it followed, approximated physical simultaneity. The 75 per cent correct-judgment points were found to be approximately ± 55 milliseconds.

To verify this unexpected finding of a close correspondence between subjective and objective simultaneity, a second psychophysical experiment was conducted. The indifference point was again found to approximate physical simultaneity. The 75 per cent correct-judgment points were approximately ± 40 milliseconds.

Microfilm \$2.75; Xerox \$6.00. 121 pages.

EXPERIMENTALLY INDUCED "REPRESSION" AS A FUNCTION OF PERSONALITY VARIABLES

(Order No. Mic 61-2616)

Marguerite M. Wilke, Ph.D.
New York University, 1958

Adviser: Leland W. Crafts

This study was designed to test certain hypotheses concerning experimental "repression" in relation to

personality variables. It was predicted that (1) subjects characterized as more "hysterical" than "psychasthenic" would react with "repression" to experimental treatment following the Zeller model, and that (2) subjects characterized as more "psychasthenic" than "hysterical" would show little or no "repression" in response to this treatment.

Subjects were high school seniors, designated as "Hy" or "Pt" on the basis of MMPI scores.

The experimental procedure was as follows: Subjects learned a symbol-digit task to the criterion of one perfect reproduction. One day later they were given a recall test, followed immediately by ego-threat in the form of failure on a scrambled-sentences task. Immediately following this threat they were given a second recall test. A third recall test, one day later, was followed by success on a scrambled-sentences task and explanation of the bogus nature of the previous failure, as a means of removing the threat. A fourth recall test immediately followed the removal of threat, and a fifth recall test was given after another twenty-four hours. The measure of "repression" was the mean loss in recall scores from immediately before to immediately after threat. Any such loss was expected to persist, as in clinical repression, until after removal of threat.

The results for the Hy group were (1) tendency toward decrement in recall score immediately following threat, (2) recovery of the recall loss after twenty-four hours prior to removal of threat, and (3) further improvement in recall score following removal of threat. Results for the Pt group were (1) significant improvement in recall immediately following threat, (2) slight loss after twenty-four hours prior to removal of threat, and (3) no significant change following removal of threat.

Despite general conformity to expectations, suggesting a tendency toward "repression" by the Hy group and clearly showing no "repression" for the Pt group, the data appeared more consistent with a reaction-to-stress interpretation, in a motivation-theory framework, than with a "repression" interpretation.

Analysis of number-attempted scores, as a measure of output, supported this interpretation. Pt subjects showed significant increase in output immediately following threat but no significant subsequent changes, whereas Hy subjects showed a non-significant trend toward reduced output immediately after threat but significant increase after a twenty-four hour recovery period, and further increase following success experience.

Pattern analysis indicated that the sequence of changes in mean recall score was characteristic of the individual subjects, in each group, to a statistically significant extent. The group pattern for number-attempted or output scores was characteristic of a significant number of Pt subjects, but questionable for the Hy subject.

Conclusions were: (1) Reactions to failure-stress and success-praise are a function of personality variables. (2) The effect of failure-stress and of success-praise is on task performance rather than upon recall as such. This interpretation is more parsimonious than an explanation in terms of "repression," both for the present study and for the earlier Zeller-model studies. (3) Failure-stress is a source of emotional disturbance, but also had motivating effects. Different individuals are differently motivated by it, in that they have learned to respond differently to it, e.g., by compensatory striving or by defensive,

avoidance reactions. The effect of failure-stress as employed in this experiment was to facilitate or improve recall test performance of Pt subjects; the effect of the performance of Hy subjects was somewhat ambiguous, but appeared to be one of temporary impairment. (4) Success-praise as employed in this experiment had a facilitating motivational effect on the Hy group but was ineffective for Pt subjects.

Microfilm \$2.75; Xerox \$5.40. 110 pages.

LEVEL OF TRAINING AND GOAL-BOX MOVEMENTS AS PARAMETERS OF THE INTERMITTENT REINFORCEMENT EFFECT

(Order No. Mic 61-2604)

James J. Wilson, Ph.D.
New York University, 1958

Adviser: Professor Howard H. Kendler

Amount of training and patterns of goal-box movements were varied to determine the influence of these variables on intermittent reinforcement extinction effects. A continuous reinforcement and two 50 per cent reinforcement groups were trained in a runway under 22 hours of food deprivation. Subgroups had 3, 9 or 24 days training at 20 trials per day. Each subgroup contained 16 male albino rats. One of the 50 per cent groups had two feeding situations designed to increase the variety of goal-box

movements. That is, the animals experienced feeding on both a shelf and the floor and received food in the form of dry pellets and mash, one in each position. An extinction series began on the day following the end of training. Twenty trials per day were given until the extinction criterion of three successive trials with running times of 20 seconds or more was reached.

On the basis of an anticipatory goal response formulation, it was predicted that the superior resistance to extinction of the 50 per cent group relative to the 100 per cent group would increase with training until the asymptote of the strength of conditioning of the anticipatory response to the instrumental response was reached. An hypothesis attributing intermittent reinforcement extinction effects to conditioned inhibition occurring in acquisition predicted a decline in the intermittent reinforcement effect with increased level of training. It was predicted that the group with the two feeding habits would decline more slowly than the other 50 per cent group.

The anticipatory response formulation also predicted greater variability in extinction for the two feeding-habit group relative to the one habit 50 per cent group. Slower learning and greater variability in acquisition with an increase in the number of goal-box movements was also predicted.

The results failed to support the conditioned inhibition formulation. An increase in the intermittent reinforcement extinction effect with increasing training was found, supporting the anticipatory response analysis. Slower learning and greater variability in acquisition also followed the predictions of the anticipatory response analysis. However, the greater variability in extinction predicted for the two feeding-habit group was not found.

Microfilm \$2.75; Xerox \$3.00. 58 pages.

RELIGION

A HISTORICAL COMPARISON OF THE THEOLOGY OF

JOHN WILLIAMSON NEVIN AND CONTEMPORARY
PROTESTANT SACRAMENTALISM

(Order No. Mic 61-2546)

William Leslie Carlough, Ph.D.
New York University, 1961

The purpose of the study is to examine the relevance of the doctrine of the Lord's Supper in the theology of John Williamson Nevin to contemporary Protestant sacramentalism. Struggling against the Puritan influence within the Reformed churches which had transformed the Holy Eucharist into a memorial service, Nevin sought to present the Sacrament as the event in which Christ communicates his life to the participants. Recognizing in Christ a new order of humanity, he elevated the Incarnation to the keystone in the arch of sacramental theology.

For the purpose of comparison, leading theologians were chosen as modern representatives of their traditions: Yngve Brilioth and Gustaf Aulen from Lutheranism, Donald Baillie and Geddes MacGregor from the Reformed tradition, and Gregory Dix, E. L. Mascall, and Norman Pittenger from Anglicanism. The research indicated that there was substantial agreement among these writers and with Nevin in a number of areas related to the doctrine of the Holy Communion. First, all contend that the reality which gives meaning to the Sacrament is the living Word of God. Secondly, the contemporary authors insist upon a real, or genuine Presence of Christ in the Sacrament. While Nevin agrees at this point, his interpretation of the Real Presence as "the organic law of Christ's human nature" states the matter less positively. Thirdly, the recent writers believe that the Holy Communion is a "making present" of the sacrifice of Christ when the term "sacrifice" is applied both to the life and death of Christ. Because sacrifice has been associated exclusively in the past with death, Nevin avoided use of the term. But he affirms the contention that the Incarnation, and not the Crucifixion, marks the beginning of the self-giving of Christ. Fourthly, these modern writers as well as Nevin hold that in the Eucharist the members of the Body of Christ have communion with their Head. Finally, it can be said that this group of modern commentators believe that the Sacrament is both a re-presentation of past events and a promise of future fulfillment. Because Nevin regarded the Incarnation as the realization of reconciliation between God and man, this eschatological tension is missing from his system.

The study also indicated that all propositions about God are necessarily symbolic, i.e. they purport to represent indirectly a reality to which they point. Such statements (or symbolic acts) suggest an analogous relation between some factor in the finite world and the infinite. There are two basic types of analogy: the analogia entis, or analogy of being, which stresses similarity and likeness between the human and divine, and the unio hypostatica, or Incarnation, which seeks to maintain the essential dissimilarity

and diversity between the two orders. While Anglo-Catholics tend to employ the former in interpreting the Sacrament and the other theologians examined use the latter, the exclusive application of a single analogy is not always consistent. Nevin appeared also to vacillate in his handling of analogy. There is an implicit avowal that either analogy, by itself, imposes too rigid a structure upon the eucharistic act. The conclusion is drawn that here, as in the doctrine of the Sacrament itself, Nevin presaged many recent emphases in modern Protestant sacramentalism.

Microfilm \$2.75; Xerox \$9.00. 198 pages.

METAPHYSICS, LANGUAGE, AND THEOLOGY.

(Order No. Mic 61-1072)

Frank Brown Dilley, Jr., Ph.D.
Columbia University, 1961

The thesis that the nature of metaphysical thinking is best described in terms of a "root-metaphor" or "confessionalist" or "tentative hypothesis" theory of metaphysics is presented at length and defended, making extensive use of the writings of A. N. Whitehead and Stephen Pepper. Effort is made to detail the consequences of such a theory for problems of metaphysical method, and of symbology. That all metaphysical thinking is shaped not only by what is "out there" but also by antecedent metaphysical conclusions which determine in part how reality is seen, what methods are thought to yield cognitive results, and what kinds of symbols and modes of symbolic reference are deemed necessary, has important consequences. What seems to be true is in part conditioned by the perspective through which things are viewed. Similarly, what cognitive methods are regarded as informative and what types of symbols and modes of symbolic reference are deemed to be necessary are also conditioned by perspective.

The adoption of a criterion of truth, or symbology, assumes the validity of the kind of metaphysic which is the legitimate parent of such a criterion, and can be known to be valid only if the adequacy of the parent system can be established. To assert the sufficiency of a particular cognitive method is at the same time to assert or "confess" the adequacy of some particular metaphysic.

Peculiar problems raised traditionally by theism having to do with peculiarities of language, of cognitive method, and of modes of symbolic reference are discussed. Some aspects of recent discussion concerning theism and the verification principle are presented, and the unverifiability of theism in these terms is accepted without alarm. The attempt to derive religious language from authority is then presented and rejected. It is argued that the "tentative hypothesis" theory of metaphysics provides a more adequate analysis of the way in which theistic discussion is actually carried on.

A chapter on symbols develops the thesis that questions about the adequacy of special terms or of special modes of symbolic reference are basically metaphysical questions, undecidable except as metaphysical questions are decided because of the way in which particular symbolologies are related to particular metaphysical descriptions.

Some consequences for the problem of establishing the adequacy of metaphysical systems are detailed. Some ways to establish the existence of God are examined, and an attempt is made to bring all of the legitimate types of proof into harmony with the "root-metaphor" theory of metaphysics.

The attempt is not to defend any particular metaphysic but only to present and defend a theory of the nature of metaphysics, to delineate the kinds of problems which must be discussed, and the kinds of appeals which must be made in establishing the validity of particular metaphysical descriptions. The investigation is merely a prolegomenon to the more crucial tasks of creating and defending actual metaphysical descriptions, and of ascertaining what religious symbols are the cognitively adequate ones.

Microfilm \$2.75; Xerox \$9.00. 199 pages.

THE NATIONS IN SECOND ISAIAH

(Order No. Mic 61-2865)

Earle John Hamlin, Th.D.

Union Theological Seminary in the City of New York, 1961

This essay is an attempt to articulate the complex motif of the nations in Second Isaiah. Its thesis is that the life and mission of Israel were radically reinterpreted by this voice from the darkness of the sixth century B.C. The new point of orientation is the new word of Yahweh which occurs at the mid-point of the prophecies:

Turn to me and be saved
all the ends of the earth,
for I am God and there is no other!
By myself have I sworn,
from my mouth has gone forth in righteousness
a word that shall not return:
"To me every knee shall bow,
every tongue swear!"

(Isa. 45:22-23)

In this word the history of the world and the sacred tradition of Israel converge. Israel carries the invitation in her mouth, and bodies forth the word in her life. Her life is henceforth to be among the nations in an Exodus from Babylon to the ends of the earth until they turn, first as communities of the sons of Zion for whom the nations act as guardians, and then as entire nations.

The first part of this study looks at the historical matrix in which the new word was spoken. A detailed analysis of two Hebrew sixth century "world maps" affords a panoramic view of the actual nations and peoples known by Second Isaiah. A survey of the reign of Nabonidus gives a picture of the last days of Babylon, the crisis out of which the prophecies of Second Isaiah arose.

Part II investigates the scope and meaning of the terms associated with the phrase "all the ends of the earth." The

inclusiveness of Second Isaiah's vision is seen in the words "all flesh," "man," "people," "generations," "earth," "the ends of the earth," and the "coastlands." Each of these terms gathers up ancient Hebrew traditions on the one hand, and shatters Hebrew parochialism on the other. The hopes of Israel are set in the context of a new earth, to be inhabited by a new family of nations in covenant with the true God.

The implications of the words "turn to me" in the invitation, form the content of Part III. The nations must turn from their present condition. They are pictured as oppressors of the humiliated slave who is also the honored servant of Yahweh. They are engaged in manufacturing gods or manipulating them, all of which places them in enmity to Yahweh. But they are also in despair and are forced to recognize their own mortality. In each of these categories, the meaning of the invitation is pressed by Second Isaiah's new interpretation of the meaning of the life of Israel, which comes to its climax in 51:13-53:12.

Part IV deals with the other part of the invitation, "be saved." The salvation of the nations is the goal of history. Besides the nations themselves, Cyrus and Israel are the chief actors in this drama. The one is the Shepherd of the "survivors of the nations" after the eschatological time of troubles. The other is the humble Servant of Yahweh serving as missionary, promise of restoration, and leader for the nations. In discussing this motif it is shown that Second Isaiah is drawing on Israel's earliest memories which arose in the shadowy days of the patriarchs. Finally, the manner in which salvation comes to the nations is examined, as the word of promise is fulfilled.

Microfilm \$3.95; Xerox \$13.95. 306 pages.

HISTORY OF THE EXEGESIS OF CHRIST'S TEMPTATIONS IN THE EARLY CHURCH

(Order No. Mic 61-1078)

Veselin Kesich, Ph.D.
Columbia University, 1959

This dissertation covers the period from the New Testament times up to Chalcedon. The exegesis of Christ's temptation by the Greek Fathers forms the essential part of this work, although a chapter is devoted to the Latin Fathers of the same age, showing their dependence upon them. Their exegesis belongs rather to the field of Biblical theology than to scientific exegesis in the modern sense.

The work begins with the New Testament account, showing how its writers used typology to call attention to the meaning of Christ's temptation. In the Apocryphal New Testament, however, Christ's temptations were ignored as offensive to the Gnostics and to the unlearned Christians, who could not imagine that Christ could be tempted.

In the Ante-Nicene period, the story of temptation is considered against the background of disputes with the Gnostics and conflicts of the early Christians within the Empire. Irenaeus gave a full exposition of the synoptic record of the temptation. He introduced the story to indicate to the Gnostics that the Logos was always united with Jesus, remaining quiescent so that He could be tempted.

The ancient exegesis was particularly apologetic in character. The Fathers differ in the way that they use the story of Christ's temptation for apologetic purposes. Those who were brought up in the school of allegory (Origen, for example) took one or two verses from the story to refute their opponents, whereas those who had a stronger historical sense (Theodore of Mopsuestia, for example) used the meaning of the narrative as a whole to combat their foes.

In the Ante-Nicene period, Justin, Tertullian, and Origen used the third temptation to show that obedience to God's commandment was above allegiance to the Empire. Eusebius of Caesarea, who was active in Constantine's era, no longer applied this temptation to the relations between the Church and the Empire, and for political and theological reasons ignored its possible disruptive aspects.

During the period of Christological controversies, the story of the temptation was considered in the context of two main theological conceptions: hypostatic union (Athanasius, the Cappadocians, Cyril of Alexandria) and prosopic union (Nestorius). The temptation narrative was used as a testing ground for these two christologies, as well as for the "refined subtlety" of Apollinaris. The Nestorian concept of "composite prosopon" in the Incarnation, as his exegesis of the temptation implies, recalls the Gnostic teaching of "double personality." Although the conception of hypostatic union does not give the Fathers as much basis to develop Christ's moral struggle as Nestorius had, it enabled them to overcome the implications of the metaphysic of Nestorius as well as of Apollinaris.

Microfilm \$3.35; Xerox \$11.70. 260 pages.

**RELIGIOUS TOLERANCE AND THE
CHRISTIAN FAITH: A STUDY CONCERNING
THE CONCEPT OF DIVINE OMNIPOTENCE
IN THE INDONESIAN CONSTITUTION IN THE
LIGHT OF ISLAM AND CHRISTIANITY.**

(Order No. Mic 60-6697)

Walter Bonar Sidjabat, Th.D.
Princeton Theological Seminary, 1960

The achievements of modern technology have brought the members of the "great" living religions into close contact with one another. There is no possibility of avoiding the challenge which the pluralism of religious loyalties and its relation to the problem of truth poses for individuals, groups, and governments. The exclusiveness claim of various religions raises the problem of religious toleration. Consequently, the Christian Church, spread throughout the world and insisting upon the uniqueness of the Gospel, cannot shirk the responsibility of approaching this matter as a theological question. It is the purpose of this dissertation to study the problem of tolerance, particularly for Protestant Christians, to show that the terminology "religious tolerance" may be used by them legitimately, and that there are strong theological grounds for this perspective.

Since the author of this dissertation is concerned with this problem as it arises in Indonesia, the presentation involves an analysis of the thought of certain contemporary leaders, such as Sukarno, and an extended descrip-

tion of religious tolerance in Indonesia, where the problem is acute because of geographical location and religio-historical background, and where the interaction of various religious bodies may be observed. This aspect of the dissertation is followed by a critical analysis of religious tolerance in Islam and in Christian faith and life.

The conclusions of the study may be summarized as follows. In spite of the fact that Islam supplied the inspiration to the 1945 Constitution of the Republic of Indonesia, and is linked inseparably to the constitutional development of the country, the principles in the "Pantja Sila," e.g., the Divine Omnipotence, have been interpreted by some Indonesians as guaranteeing religious tolerance. True religious tolerance includes the provision of the right to freedom of thought, conscience, and religion, the freedom to alter one's religious belief, and freedom, either alone or in community with others, privately or publicly, to manifest this religious belief in worship, teaching and practice. The Indonesian Constitution may be interpreted in this light. But the establishment of an independent Ministry of Religious Affairs from 1946 until July 9, 1959, complicated the problem of religious tolerance as intended by an interpretation of the "Pantja Sila" in favor of Islam and to the hardship of other religious groups. The preponderant insistence of the Muslims to maintain the interdependence of religious and state affairs hinders the practice of religious tolerance in the country. Therefore, the situation in Indonesia requires a more careful definition of the functions of the State and religious institutions in order to provide for the general welfare. A theological revival among Muslims may bring some readjustments in Islamic thought, e.g., in the law of apostacy, and thus a modification of Islam's relationship to other religions.

What should Protestant Christians say in this situation? Among some observers Christianity has the reputation of being the most intolerant religion. Christians may make clear that they stand for religious tolerance without becoming the victims of relativism, skepticism, or syncretism. In the meeting of many religions, the Christian may make a distinction between the confessional intolerance and civil intolerance, the latter being accomplished by physical or mental coercion. For the Christian, the concept of general revelation is a very weak foundation for religious tolerance. The best theological grounds for such a position are: the conception of witness which is basic to the spread of the Gospel of Christ; the realization that Christian faith is the gift of God; a humility molded by the awareness of the role of the Holy Spirit in the act of one's faith; a realistic understanding of the nature of the present "world" in the light of eschatology; a desire to eliminate error among Christians and non-Christians in a spirit of love and as a sign of forgiveness; and the acknowledgement that God's bountiful grace in Jesus Christ is meant, not for an exclusive people, but for the whole world.

Microfilm \$4.35; Xerox \$15.30. 338 pages.

**A STRATEGY OF WORLD MISSION:
THE THEORY AND PRACTICE OF
MISSION AS SEEN IN THE PRESENT
WORLD MISSION ENTERPRISE OF
THE DISCIPLES OF CHRIST.**

(Order No. Mic 61-1044)

Joseph Martin Smith, Th.D.
Union Theological Seminary in the City of New York, 1961

This study analyzes the so-called revolution in missions in terms of the theory and practice of a single American denomination, the Christian Church (Disciples of Christ). The Disciples' strategy of world mission, developed and articulated by The United Christian Missionary Society in an effort to translate the insight of ecumenical missionary conferences into denominational policy, forms the substance of the analysis. It advances the thesis that a genuine revolution in missions involves not merely changes in mission practice but calls also for a revision of the denomination's self-image in which it both capitalizes upon and transcends its heritage.

When Disciples began seriously to engage in foreign missions late in the nineteenth century, their characteristic ethos as an indigenous, American religious movement with a special sense of mission to restore the lost unity of the church by a "return to New Testament faith and practice," was already fixed. Their organization of missionary societies occasioned schism within the denomination and, at the same time, provided the scaffolding upon which a national structure of cooperation, hitherto lacking in the radically congregational denomination, was developed. Participation in foreign missions helped the Disciples to accept reluctantly a new self-image as a denomination among denominations. From a "brotherhood" with the special mission of restoring the unity of the church as a prelude to the conversion of the world, the Disciples moved to the place where they conducted "foreign missions" as a necessary function of a "major" denomination and substituted interdenominational cooperation for "restorationism" as the way to recover Christian unity.

The "strategy of world mission" is a Disciples response to the external challenge of radical changes in the environment of world mission and the internal challenge of union by Disciples "younger churches" in Japan and the Philippines with non-immersionist, non-congregational bodies. The strategy commits Disciples to closer partnership with the "younger church," and to "mobility and flexibility" of operation with "church growth" as the determinative norm in the establishment of priorities. It sanctions the united church relationships in Japan and the Philippines and encourages missionaries and nationals to further church union on other fields.

Response by missionaries and nationals to the "strategy of world mission" reveals them as heirs of a pietistic individualism which lacks a doctrine of the church and reflects the restorationist's anti-historicism in the lack of a common understanding of the relationship of the gospel to culture.

Implementation of the "strategy of world mission" has served mainly to bring into clearer focus the problems confronting mission administrators committed to the necessity of revolutionary changes in world mission. A genuine revolution in their mission theory and practice will require Disciples: (1) to recover a meaningful self-image

that does justice to the catholicity as well as to the unity of the church; (2) to renew their sense of mission by a new grasp of the realities of the gospel, and, (3) to relate mission more relevantly to the total structure of man's life in community through recovering the valid elements in the concept of Christendom. Ecumenical instruments of mission, such as The International Missionary Council, should provide mission boards with additional support for translating ecumenical insight into denominational action and prepare to move further toward the "internationalization" of missions. Microfilm \$6.15; Xerox \$21.85. 482 pages.

**CONTEMPORARY TRENDS IN
PHILOSOPHY OF PROTESTANT
RELIGIOUS EDUCATION**

(Order No. Mic 61-2571)

Norma Hoyt Thompson, Ph.D.
New York University, 1961

Chairman: Professor Lee. A. Belford

Statement of the Problem

The purpose of this investigation is to identify and trace the basic philosophical trends in contemporary Protestant religious education. This process involves: discovering what philosophical problems are current in religious education; determining changes in emphases and ideas during the period under study (1940-1960); and ascertaining present trends with regard to such problems.

Procedure

The problems of current concern in philosophy of religious education were established. Four major problem areas emerged: (1) theory of reality, involving a view of the universe, nature of God, and nature of man; (2) theory of knowledge, including the role of the Bible in religious education; (3) theory of value, especially source of value, ethics, and values realized in worship, the Church, and the home; (4) implications for curriculum, content, methodology, evangelism, missions, and general education.

Emphases and changes were traced through books, articles, and pamphlets written since 1940 dealing with these problems. Points of view were grouped and compared to reveal similarities, differences, and conflicts, and to determine direction in philosophy of religious education.

Findings and Conclusions

Both individual religious educators and denominations tend to take an eclectic approach to philosophy of religious education, choosing aspects of various philosophical systems according to theological concepts.

Study of the current problems in philosophy of religious education reveals that existentialism is probably the most influential current philosophy in Protestant religious education, as reflected in emphasis upon man in his existential situation, filled with anxiety and with a keen sense of his predicament as a finite being; in the concept of God as able to meet these deep needs of man in the encounter between the divine Person and man as person; in negation of rational knowledge; in emphasis upon the experience of the self in relationship to other selves; and in a methodology

dependent upon communities in which God's love becomes manifest through interpersonal relationships.

Other philosophies which retain considerable influence in religious education are personal theistic idealism, experimentalism, biblical realism, Christian theism, and dynamic naturalism.

Personal theistic idealism is reflected in the concept of Ultimate Reality as Personal; in emphasis upon learning as the response of the finite self to the Infinite Self; in the concept of the pupil as a developing personality; and in the importance of mental capacities in the educational process.

The strong influence of experimentalism is indicated by the continuing concern for starting with the needs and interests of pupils; the problem-solving method; the life-situational approach to curriculum; and the use of creative projects in teaching.

Biblical realism is found in the concept of God as objective reality; in the biblical picture of the nature of

man and his relationship to God as a record of God's revelation of Himself; in the educational process as an effort to help the pupil through experience and learning of the facts of the Christian faith to understand the Biblical picture and attain a right relationship to God.

Christian theism, like idealism, makes God's revelation a "Word"--Christ the Word, but also the Word as revealed in the Bible. Here is a revelation from God which man must know and accept in order to be redeemed. The pupil is viewed as a sinner in need of redemption; emphasis is placed upon knowledge of the facts of salvation, and mental acceptance of those facts.

Dynamic naturalism sees Ultimate Reality as within the natural; man as united with reality; and the religious educator's concern as helping the pupil see himself as a part of the universe, come to depend upon the universe, and help the creative process at work within the universe.

Microfilm \$6.05; Xerox \$21.40. 475 pages.

SOCIAL PSYCHOLOGY

SEXUAL IDENTITY AND POLITICAL IDEOLOGY

(Order No. Mic 61-2747)

Theodore Nichols Ferdinand, Ph.D.
University of Michigan, 1961

This study was designed to test the hypothesis that psychological femininity in males is positively related to political liberalism. After a careful scrutiny of the work of such political writers as Sabine, Laski, and de Ruggerio, a definition of political liberalism was developed that consisted of the attitudes of Humanitarianism, Aconventionalism, Pro-governmental Service, and Pro-governmental Power. The definition of psychological femininity was based upon the work of such psychoanalytic writers as Klein, Boehm, and Abraham and such psychologists as Terman and Miles, Hathaway and McKinley, and Gough. It consisted of the following traits: Sexual Timidity, Physical Timidity, Rigorous Moral Standards, Hope for Success, Fear of Failure, Lack of Subordination, Sensitivity, and Social Poise.

A questionnaire was constructed by the author to measure these variables as well as the usual control variables and administered to students at the high school, college, and graduate school level. Altogether 964 completed questionnaires were gathered from these groups.

After careful analysis, it was found that Humanitarianism correlated .167 and Aconventionalism correlated .402 with psychological femininity in males. These relationships persisted even after the influence of such variables as social class, family structure, and religious affiliation were controlled.

The relationships between family structure and psychological femininity were also examined. Although it was hypothesized that the greater the mother's authority in the family, the greater the degree of psychological femininity

exhibited by her sons, no consistent relationships were uncovered. There was evidence, however, that sons from mother-dominant families tended to be more responsive to the exigencies of their immediate situation while the sons from father-dominant families tended to be more responsive to the pressures of their cultural environment.

It was concluded that two dimensions should have been used in the original definition of psychological femininity, namely, the degree of basic psychological femininity exhibited and the attitude toward psychological femininity. Four personality types were constructed on the basis of these two dimensions -- the feminine and masculine types and the anti-feminine and the anti-masculine types. When the political attitudes of these four types were examined, it was found that the feminine type exhibited a significantly higher degree of Humanitarianism than either the masculine or the anti-feminine types while the anti-masculine type was significantly more Aconventional than both the feminine and the anti-feminine types. It was suggested, therefore, that the anti-feminine type resembled the authoritarian conservative discussed by Adorno and that the anti-masculine type resembled the authoritarian radical described by Shils.

In conclusion it was stated that two general problems contributed to the nature of the findings. First, the methodological problem of measuring a relative attitude like Aconventionalism made it unlikely that a general relationship between it and psychological femininity would be found. Second, the failure to anticipate theoretically the complex nature of both psychological femininity and family structure made it likely that any relationships between psychological femininity and either family structure or political liberalism would be weak.

Microfilm \$2.75; Xerox \$8.80. 194 pages.

**A SOCIAL-PSYCHOLOGY OF
DELINQUENT BOYS**

(Order No. Mic 61-2752)

Martin Gordon Gold, Ph.D.
University of Michigan, 1961

The impetus to this research is an interest in the relationship between position in the social structure and personality development. The specific problem researched is the relationship between social status and juvenile delinquency. Two questions focus this study: (1) Why are lower status boys disproportionately represented among delinquents? and (2) are the factors associated with delinquency among lower and higher status boys similar?

Site of the study is a Michigan city of about two hundred thousand population. Data sources were ecological records, school records, and interviews with parents and their adolescent sons. The central research design involved ninety-three boys with records of two or more serious legal offenses, matched with ninety-three non-delinquents on age, intelligence, grade in school, race, and father's occupation.

This research yields another set of data which demonstrate that lower status boys are disproportionately delinquent: higher rates of police contacts with boys tend to appear in lower status elementary school districts.

Three processes which might link social status to delinquency are explored:

A. (1) Lower status neighborhoods have poorer recreational and educational facilities; (2) neighborhoods with poorer facilities are less attractive to boys; and (3) boys who are less attracted to their neighborhoods are more likely to be delinquent.

B. (1) Lower status families, especially fathers, are less attractive to their sons; (2) less attractive families will have less control over their sons; and (3) where the control of families, especially fathers, is weak, sons will more likely be delinquent.

C. (1) Lower status boys will more often anticipate failure to enter prestigious occupations to which they aspire; and (2) the discrepancy between occupational aspirations and expectations will provoke boys to delinquency.

Process A is not supported by the data, since only the attitudes of delinquents toward their neighborhoods vary with the quality of recreational and educational facilities. The data do demonstrate links (1) and (3), however.

Process B is generally confirmed by the data, with factors such as father's occupation and the type of punishment techniques he employs affecting attractiveness. Mothers' influence is also shown to be weaker among delinquents than among non-delinquents.

Process C is not confirmed by evidence of greater discrepancies between occupational aspirations and expectations among delinquents; rather, these delinquents tend to have lower aspirations than non-delinquents and tend to be more confident of achieving their lower aspirations. However, data indicate they are aspiring to occupations they judge to be lower in prestige. These findings are interpreted to mean that their lowering of aspirations is a means of coping defensively with a status problem which might well be provocative to delinquency, as hypothesized. Data also suggest that anticipated failure to achieve prestigious occupations is signaled by poor school achievement and is perceived by boys as personal failure, not the fault of the social system.

Delinquency among higher and lower status boys seems to be associated with the same processes.

In order to see if behaviors found characteristic of repeated delinquents were perhaps consequences, not fore-runners, of boys being at least twice-labeled delinquents, one-time delinquents and non-delinquents who became repeated delinquents after being interviewed, were investigated. Data indicate that the small number who became repeated delinquents had earlier behaved more like repeated delinquents than did matched boys who did not become repeated delinquents.

Implications of this study are drawn for delinquency among Negroes, girls, and several ethnic groups; for problems of treatment and control; and for the general problem of the relationship between social status and personality development.

Microfilm \$4.60; Xerox \$18.00. 359 pages.

**RIGIDITY OF CONCEPT UTILIZATION
AS A FUNCTION OF INDUCTIVE AND
DEDUCTIVE DERIVATION**

(Order No. Mic 61-1109)

William Robert Hood, Ph.D.
The University of Oklahoma, 1961

Major Professor: Muzafer Sherif

On the basis of a survey of experimental literature on concept formation, an experimental separation of concept strength and rigidity of concept utilization appeared possible. Strength has been inferred from point-in-time measures, and it was suggested that rigidity might be usefully conceived as initial resistance to change followed by sudden or rapid change.

Numerous experiments have demonstrated that stronger concepts are held more rigidly. Grounds were also found for predicting that concepts derived deductively (learned by instruction, dictum, or formula) might be more rigidly utilized than concepts derived inductively (learned through direct, sequential experience with the referent of the concept).

The experimental design involved production of concepts (expectations that subsequent stimuli would be related to food and eating--category items) deductively and inductively for different groups of subjects. Conditions were designed to produce expectations at "All" or "Most" levels for subgroups of Deduction and Induction subjects. Control subjects developed no concepts.

Stimuli responded to by 320 subjects were "skeletons" (words with letters missing) for which probabilities of category and noncategory response had been determined. Deduction subjects responded to ten noncategory practice words and were then instructed that all (or most) of the words to follow related to food and eating. Induction subjects responded to ten of ten (all instructions equivalent) or eight of ten (most instructions equivalent) stimuli of very high category response probability.

The resulting concepts were tested for initial strength through subject responses to ambiguous test stimuli--words to which category and noncategory responses were approximately equally probable. Subjects then responded sequentially to three further stimulus sets of decreasing

probability and possibility of category response which were designed to discredit or invalidate subjects' concepts. Rigidity of concept utilization was revealed through initial resistance to change followed by sudden change in proportions of category responses to these sets of discrediting stimuli. Finally, subjects responded to another set of ambiguous stimuli designed to assess the relative ease of reinstating the discredited concepts.

In relation to hypotheses tested, the following statements can be made at statistically respectable levels of confidence: (1) Concepts derived deductively were initially stronger than those derived inductively. (2) Experimentally-produced concepts were discredited. (3) Deductively-derived concepts were utilized in a slightly more rigid manner than inductively-derived concepts of equal initial strength. Stronger concepts were also more rigid, and absolutistic (All expectation) concepts that had been derived deductively were more rigid than concepts of other experimental subjects. Experimental subjects exhibited greater rigidity than control subjects. (4) Ease of reinstatement of discredited concepts was not significantly related to these experimental variables.

Theoretical and practical implications of these results were discussed, and suggestions were made for further research. Microfilm \$2.75; Xerox \$6.20. 128 pages.

**THE NEUTRAL ISOLATE: SOME PERSONALITY,
BEHAVIORAL, AND ROLE PERCEPTION DYNAMICS
OF PRE-ADOLESCENT SOCIO METRIC ISOLATES
COMPARED WITH A GROUP OF
SOCIO METRIC LEADERS.**

(Order No. Mic 61-2552)

Paul Hurewitz, Ph.D.
New York University, 1961

Chairman: Professor Louis E. Raths

Statement of the problem. The purpose of this study was to compare and describe some personality and role-perception dynamics of pre-adolescents (boys and girls, ages nine to twelve years) who were identified as isolated on various sociometric instruments.

A group of nineteen neutral isolates was selected from a population of 1,167 children who attended five public elementary schools in Brooklyn, New York.

Methods and procedures. The group of isolates was compared with a group of sociometric leaders on various personality and role-perception dimensions.

Variables, other than personality and role-perception factors, were analyzed to determine if they contributed to isolation. They were as follows: Physical Differences, Age Differences, Educational Adjustment, Intelligence, Socio-economic Differences, and Propinquity.

The groups were equated on the basis of sex and grade placement. Each isolate was matched, wherever possible, with a leader from the same classroom.

Summary and Conclusions.

Personality factors. The findings supported the hypothesis that there was a significant degree of emotional

instability and disturbance in the isolate group. (Seventy-two per cent of the isolates were maladjusted as compared to 21 per cent of the leaders.) The gap in relating mutually reflected an inadequate self-system.

Sociometric isolation cannot be considered an absolute condition of personal maladjustment, and sociometric leadership cannot be considered an absolute condition of personal adjustment when predicting individual cases.

Isolates did not actively withdraw from their environment. They continued to choose others and were not observed by their classmates as being exceptionally quiet.

Role-perception factors.

Self-perception. The isolates and the leaders were aware of their sociometric position. The isolates tended to overestimate their social relations with others and the leaders tended to underestimate their social relations with others.

The isolates' perceptions reflected the element of wish-fulfillment while the leaders' self-perceptions indicated the reality, that one cannot be everyone's best friend, although, many people would have liked to be such.

The isolates and the leaders rated themselves and were rated by the classmembers in various roles. The findings were as follows:

Isolates and leaders saw themselves in similar role-status positions. The isolates were significantly less accurate than the leaders in predicting their own positive role status.

The classmembers observed the isolates in more neutral roles than they observed the leaders (both groups were observed in relatively few neutral roles).

There were sufficient individual differences to indicate that accurate self-perception was an important but not an essential factor for individual predictions of leaders or isolates.

Role perception by classmates. The classes saw the leaders in significantly more status positions than the isolates, and the leaders were observed in many more positive status positions than neutral status positions.

The majority of the isolates were observed in a neutral status, either by absence of vote or by placement into a neutral role.

A few leaders had similar role patterns when compared to the isolates.

Perception of class status structure. The leaders were more accurate than the isolates in predicting the status roles of classmates; however, many of the isolates had similar accuracy scores when compared to the leaders.

Other factors. Poor school adjustment and achievement seemed to differentiate isolates from leaders and average group members.

Summary. The neutral sociometric status of isolates seemed to parallel neutral role status. The isolates seemed unable to project themselves into friendship roles as well as positive status roles.

A number of personality measures significantly differentiated the isolate group from the leader group. These measures were found to be useful in prediction of individual isolates and leaders.

Microfilm \$3.95; Xerox \$13.95. 306 pages.

**AN EQUILIBRIUM MODEL OF
A RELATIONSHIP BETWEEN
FEELINGS AND BEHAVIOR**

(Order No. Mic 61-2770)

Thomas Stephens Lough, Ph.D.
University of Michigan, 1961

The model described in this study is based upon the observation that people sometimes do what they feel like doing. Specifically, the model is based upon two concepts and their consequences. The first is that molar human activities are accompanied by fairly stable patterns of feeling intensities, where feelings are whatever one refers to when he says that he feels good, anxious, confident, or the like. These patterns of feeling intensity are assumed to vary from person to person and with the various kinds of behavior which occur in the normal life of any particular person. The second concept is that during his free time the individual attempts to compensate for disequilibria in his feeling states which have occurred and accumulated during prior, non-free time intervals. Consequently, during his free time the individual is assumed to choose to engage in classes of behavior which are associated with those feeling intensities which are most liable to compensate for the prior disequilibria.

These concepts and their consequence were developed into a set of definitions, assumptions, and rules which constitute the model. Thirty variations of the model were tested using self-observation data obtained from three paid subjects. Each subject was required to record--at 20-minute intervals during his waking hours for seven days--what he was doing and the intensities of his feelings. The feelings, the intensities of which were rated on seven-point scales, were based upon high factor loading adjectives found in C. E. Osgood's studies of the "semantic differential."

The inputs to the model were thus: 1) patterns of feeling intensity associated with classes of each subject's behavior, 2) the times at which each subject had free time, 3) the ongoing feeling intensity ratings, and 4) values of the various parameters which defined disequilibrium in each of the model variations. The outputs of the model were "predictions" of what each subject would do during each free time period of the observed week. A "prediction" was correct when it coincided with what the subject actually did do during the particular free time period.

The average ratio of successful to unsuccessful predictions (over-all subjects, free time periods and model variations) was 12.7%; the range was from 5.4% to 29.4%. The over-all statistical significance was negative. No consistent differences were found among subjects or model variations.

A post-mortem analysis uncovered no definitive relationships between feelings and behavior, but did suggest that the model failed because of the arbitrarily assigned values of the parameters. Among the suggestive findings were that different kinds of behavior were successfully predicted depending upon whether disequilibria were accumulated over long or short periods of time, and that different feelings varied in their effects upon behavior within and among subjects. The prediction that subjects sought maximum (but appropriate) pleasure during their free time was borne out for 17.6% of the predictions.

It is concluded that the data should be examined to

arrive at an optimal model which will show how much of free time behavior can ideally be accounted for with this kind of model. The optimum model should also indicate sophisticated criteria for setting the parameters of future predictive models.

The chief values of the present study are taken to be that it is one of the very few intensive longitudinal studies of everyday human behavior, that it demonstrates the feasibility of gathering these kinds of longitudinal data, and that it is an attempt to model in a rigorous way one of the many intuitively reasonable notions about behavior and to predict ongoing everyday behavior on the basis of such a model. Microfilm \$3.20; Xerox \$11.25. 247 pages.

**FAMILY DYNAMICS IN RELATION TO
CONSCIENCE AND DEVIANT BEHAVIOR
AMONG ADOLESCENT BOYS**

(Order No. Mic 61-2793)

Charles Norman Holmes Seashore, Ph.D.
University of Michigan, 1961

The purpose of this study was to determine the association of conscience strength in adolescent boys with (1) parent-child relationships and (2) deviant behavior. One sign of conscience was examined in detail; the degree of congruence between the boy's internal standards of behavior and the standards of behavior which his parents held for him. A related interest was to determine if there were social class differences in parent-child relationships which could account for the fact that delinquency rates in the lower classes are higher than in the middle class.

Eighty-nine non-delinquent and seventy-eight delinquent boys and their parents were interviewed in this study.

The development and maintenance of congruent standards of behavior was seen as a function of two closely related processes, identification with the parent and internalization of parental standards. Identification refers to the process by which the child adopts parental behaviors and attitudes because he loves the parent, respects the parent's power, or both. Internalization refers to the process by which the boy adopts parental standards of behavior because he judges those standards to be reasonable and useful.

The following parent-child relationships were predicted to contribute to the development of congruence through the processes of identification and internalization: a parent's use of reasoning when the boy misbehaves; high parental agreement on how to handle the child; father dominance as opposed to an equalitarian family structure when there is low parental agreement; high attraction to a parent; a parent's use of love-oriented rewards; the boy's perception of being positively evaluated by a parent; and inclusion of the boy in activities with a parent. It was predicted that the father would be the more important parent in influencing congruence in the adolescent boy. Congruence, in turn, was predicted to be negatively related to deviancy.

As expected, delinquents had lower congruence scores than non-delinquents. Other hypotheses were tested for the delinquent and non-delinquent groups separately.

Among the delinquent group, relatively high congruence

was found to be associated with the following factors; (1) the mother's use of reasoning; (2) an equalitarian family structure and high parental agreement; (3) high attraction to the father; (4) positive evaluations from each parent; (5) high inclusion with each parent.

Among the non-delinquent group, high congruence was found to be associated with the following factors; (1) the father's use of reasoning; (2) father dominance and low parental agreement or an equalitarian family structure and high parental agreement; (3) high attraction to the father; (4) the mother's use of non-love-oriented rewards; (5) the father's use of love-oriented rewards; (6) positive evaluations from each parent; (7) high inclusion with each parent.

There was strong support among the non-delinquents for the hypothesis that the father was the more important parent in socialization while for the delinquents there was a trend for the mother to be the more important parent. These findings suggested that it was difficult for the boy to develop strong enough internal standards to control delinquent behavior if the boy's relationship to the father was disturbed. It was also suggested that the influence of the mother was based on other factors than the boy's attraction to her.

It was found that some of the same parent-child relationships were consistently associated with congruence in different social classes. However, there was no support for the proposition that social class differences in parent-child relationships could account for high delinquency rates in the lower classes.

Microfilm \$2.75; Xerox \$6.40. 133 pages.

VOCATIONAL ASPECTS OF TUBERCULOSIS:
A COMPARISON OF CERTAIN OCCUPATIONAL
FACTORS FOUND IN A GROUP OF REACTIVATED
AND A GROUP OF NONREACTIVATED
PATIENTS FOLLOWING DISCHARGE.

(Order No. Mic 61-2582)

Arthur Jess Wilson, Ed.D.
New York University, 1961

The purpose of this study was to investigate and compare two groups of discharged tuberculous patients, one a reactivated and one a nonreactivated group, with reference to certain occupational factors. The importance of this study derives from the developments in the past decade in tuberculosis control programs which are directly related to occupational factors.

This investigation represents a five-year follow-up study and comparative analysis of 100 tuberculous patients who were discharged with medical approval from Grasslands Hospital of Westchester County in New York State. All subjects were interviewed and tested between a period of not less than five nor more than six years following their dates of discharge because it was assumed that the variability in occupational factors may have been increased with an increase in the length of the discharge interval.

This is an ex post facto study which sought to examine

two groups of subjects at two different periods of time so that comparisons could be made. The following methods were used in collecting data: (1) interviewing, (2) testing, and (3) investigating documentary sources. A battery of five tests was administered to every subject of the research population in the following areas: intelligence, vocabulary, personality, interest, and aptitude.

The first of the major problems was to select two groups of discharged tuberculous patients which were similar in certain basic characteristics at discharge except that one group had reactivated and one had not. Fifteen variables were investigated at point of discharge. The opposing groups also were compared with respect to nine characteristics which appeared to be fundamental to their uniformity at survey.

The chi square test was used to determine the significance of differences between the groups with reference to all variables investigated. In addition, the chi square test was applied to all the statistical tables to which it could be applied. The presentation of data included 61 statistical tables. The investigator selected .05 as the significance level. Chi square was translated into a "P" which presented the probability of the two groups differing by chance. The chi square test revealed that the differences between the two groups in reference to all 24 variables are not statistically significant.

The comparability of the two groups having been established, the structure was prepared for the second major problem, namely to compare the same two groups at survey with reference to 12 occupational factors which resulted in the following conclusions:

- (1) There are significant differences between the two groups with reference to certain occupational factors.
- (2) The distinguishing occupational characteristics of both groups are essentially unrelated to the physical aspects of their vocational duties, but significantly related to the psychological aspects, namely occupational status and job satisfaction.
- (3) It is suggested that because favorable socio-economic conditions permitted them to do so, a significantly greater number of the nonreactivated, than of the reactivated, subjects accepted rehabilitation training for the purpose of changing their jobs following discharge from the hospital. It seems a reasonable conclusion that, as a direct result of this change, the occupational status of these subjects was increased, and, partly as a result of increased status, they experienced an increase in job satisfaction.
- (4) Rehabilitation efforts cannot produce permanent vocational adjustment without achieving the following: (a) suitable occupational status, (b) adequate job satisfaction, (c) affirmative patient participation, and (d) a non-directive counselor-patient relationship.

The findings of this study demonstrate the advisability of a re-evaluation of the eligibility requirements of the official rehabilitation and welfare agencies with respect to financial assistance for maintenance during a period of vocational training. This study supports the contention that patients will continue to accept unsuitable employment in preference to training for more selective occupations if they anticipate financial insecurity during this period of training.

Microfilm \$3.15; Xerox \$11.05. 242 pages.

SOCIOLOGY

SOCIOLOGY, GENERAL

STUDENT-FACULTY RELATIONS IN MEDICAL SCHOOL: A STUDY OF PROFESSIONAL SOCIALIZATION.

(Order No. Mic 61-1070)

David Caplovitz, Ph.D.
Columbia University, 1961

This is a study of the socialization process in medical school. Questionnaire data collected from students and faculty members at an outstanding medical school in the Eastern United States are analyzed in order to find out which components of the physician's role are emphasized during medical school. The analysis focuses upon the faculty members nominated by students as outstanding role performers -- men they are likely to take as role models -- and the students judged by the faculty to be particularly promising physicians.

The basic finding of the study is that the acquisition of technical knowledge and skills is given much more emphasis than the acquisition of medical values at this stage in the socialization process. Both students and faculty members evaluate each other as professionals on the basis of skills and knowledge and not on the basis of values.

The first part of the analysis examines the faculty members selected as role models. It is found that students tend to admire the same men who are held in high esteem by their professional peers, men who occupy positions of prestige within the institution. Significantly, students differentiate between the more and the less esteemed faculty members of the same academic rank. Using frequency of promotion to measure professional esteem, we find that the men considered outstanding by students are more often promoted than other faculty members. Moreover, as students progress through school they become less prone to choose men of established reputation (those of highest rank) and more prone to choose esteemed men of lower rank, the "promotable" faculty members. This finding indicates that students learn the institution's standards of technical competence and become progressively more adept at applying them to the point where they can "predict" which men will subsequently be given formal recognition by the institution.

The growth of professional autonomy suggested by the assimilation of standards of competence is examined from the viewpoint of the social arrangements which contribute to it. The progressive fragmentation of the student peer group and the increasing diversification of student-faculty relations are identified as key factors in the growth of autonomy.

The second part of the analysis deals with the students chosen by faculty members as highly promising physicians and reveals that the faculty bases its judgments almost exclusively upon the medical skills of the students rather than upon the medical values they hold. Although technical and interpersonal skill distinguish the promising physicians

from other students, the acceptance of values held by the faculty does not. More detailed analysis shows no relationship between the values of faculty members and those of the students they designate as promising physicians.

These findings are in contrast with those of other studies. Unlike The American Soldier, which showed that endorsement of the values of superiors was important to advancement in the army, the present study suggests that in the medical profession advancement is linked more to technical ability than to acceptance of values.

Although students assimilate standards of technical competence, they do not accept certain other medical values of the faculty even when they are about to graduate from medical school. This gap between student and faculty values raises the question of "delayed learning" in professional socialization. It is shown that students are aware of the medical values of their teachers even when they do not accept them. Successful communication of values from faculty members to students at this stage may facilitate acceptance of them at later stages in the medical career. In any case, the study shows that clear priorities placing the acquisition of technical knowledge and skills above value-learning are operative in medical school.

Microfilm \$4.20; Xerox \$14.85. 326 pages.

A STUDY OF OCCUPATIONAL EVALUATION IN THE PHILIPPINES

(Order No. Mic 61-1422)

Gelia Tagumpay Castillo, Ph.D.
Cornell University, 1960

The purpose of this study is to investigate occupational evaluation in the Philippines. In order to accomplish this purpose, four related aspects of occupational evaluation were examined: (a) nature of the occupational hierarchy in the Philippines which results from subjective evaluations, (b) extent to which occupational evaluation in the Philippines is typical or atypical in comparison with other societies, (c) extent of agreement in the occupational evaluations made by different groups of subjects, and (d) concomitants of differential evaluation of occupations. Hypotheses and propositions to examine this aspect of the problem were derived from Kingsley Davis and Wilbert Moore's "Principles of Stratification" and E. T. Hiller's "General Characteristics of Vocational Statuses." These two theories were chosen because they are contradictory in certain respects and part of the objective of the study was to find out which of these two theories more nearly explains occupational evaluation in the Philippines.

Thirty-five hypotheses and propositions were formulated to examine these four aspects of the problem.

Methodology

The questionnaires used in this study were administered to 476 Filipino high school seniors. The subjects were asked to rate 25 occupations according to prestige and income. Nineteen occupations were rated according to their importance to the functioning of society. They were also asked to check the occupations which they would be willing to consider if the occupations were available to them. Mean ratings were computed for each occupation and were used for ranking the occupations. To test the hypotheses, the statistical tests applied were: Kendall's rank correlation and partial rank correlation coefficients, chi square test, and t test of significance of the difference between two means, two proportions or two standard deviations.

Findings

1. The occupational hierarchy in the Philippines consists of the professions and other white-collar occupations at the upper level and blue-collar occupations at the lower level.

2. In general, there is a high degree of consensus in the occupational ratings. This probably indicates a relatively standardized frame of reference for evaluating occupations.

3. Cross-cultural comparisons show high positive relationships between occupational rankings in the Philippines and those found in other countries. However, there are marked differences in the rankings of some occupations.

4. Male-female, rural-urban, and adolescent-adult comparisons of occupational ratings indicate a high degree of agreement.

5. There is little evidence of occupational bias in rating occupations. Actually the reverse tendency was observed. Subjects who come from farming and blue-collar occupational backgrounds tended to rate the professions and other white-collar occupations more favorably than those subjects who come from professional and white-collar backgrounds.

6. Occupational prestige is highly correlated with functional importance, occupational income, and occupational inclination. Occupational income seems to have no relationship to functional importance which could not be accounted for by prestige. Occupational prestige and income are positively related regardless of functional importance. Prestige seems to explain more of the variation in occupational inclination than either functional importance or income. However, functional importance and occupational inclination are still related even after the effect of prestige has been partialled out.

To a certain extent, the following factors revealed some degree of association with occupational prestige and income: conditions of work, values promoted by the occupation, level of training required for the occupation, and occasions for ceremonialism which an occupation provides.

Analysis of the fourth aspect of the problem indicated that neither Davis and Moore's theory nor Hiller's theory has been sufficiently substantiated by the data. However, on the basis of findings in this study, a tentative explanation of occupational evaluation in the Philippines is offered for further investigation.

Microfilm \$2.75; Xerox \$7.20. 155 pages.

DIRECTIVE FACTORS IN SOCIAL ACTION

(Order No. Mic 61-1833)

Ivan Joel Fahs, Ph.D.
Cornell University, 1960

The purpose of this study was to investigate the Theory of Directive Factors in Social Action which was developed by Professor William W. Reeder. According to the Theory, there are eleven factors which are significantly related, separately and cumulatively, to social action: Opportunity, Ability, Expectation, Goals, Values, Comfort, Support, Commitment, Force, Unusual Shared Experience, and Habit. These factors aid in explaining why people behave the way they do.

Research Design. The Glenview community (pseudonym) of approximately 4,000 was the site of a 1956 survey, and a systematic sample of 500 married adults provided the data for analysis. The writer selected seven different situations which represented diverse dimensions of social action: (1) civic affairs, (2) organizational participation, (3) work satisfaction, (4) family activities, (5) neighboring activities, (6) health practices, and (7) religious participation. A summary of activities in each of these situations was operationally regarded as the dependent social action variables of the study. The factors (the independent variables) were related to these activities. The data gave information for only five factors: Ability, Expectation, Goals, Comfort, and Support.

Review of Literature. Seventy-two studies are cited geographically spread over twenty-five states from 1926-1959 representing various dimensions of social action. The review builds the cited literature around each of the theoretical factors.

Analysis. Not only are the separate factors related to the seven dimensions of social action, but the cumulative effect of more than one factor is also tested by means of a sorting model designed to control the effects of factor interdependency. The cumulative effect hypothesis was supported by the data. The analysis of the factors and the cumulative effects provided the research with thirty-eight hypotheses. In twenty-nine instances the Theory of Directive Factors held; in nine, the Theory did not hold.

Implications. The Theory of Directive Factors was substantiated to the extent that it was possible to test it. It is suggested that the Theory is a useful frame of reference for understanding why people behave the way they do.

Microfilm \$3.25; Xerox \$11.25. 249 pages.

THE FORMULATION AND PARTIAL TEST OF A CLASS LINKED THEORY OF DELINQUENCY

(Order No. Mic 61-1059)

Orville Richard Gursslin, Ph.D.
The University of Buffalo, 1961

It was the purpose of this study to formulate and partially test a class-linked theory of delinquency which was consistent with the general body of sociological knowledge. Basic to the theory was the following set of interrelated propositions:

- 1.1 Lower-class adolescents in a society of disjunctive means and goals experience status-frustration.
- 1.2 Status-frustration leads to outgroup aggression.
- 1.3 Outgroup aggression leads to rejection of means and goals.
- 1.4 Rejection of means and goals constitutes delinquency.
- 2.1 Middle-class adolescents in a society of disjunctive means and goals experience status-frustration.
- 2.2 Status-frustration leads to ingroup aggression.
- 2.3 Ingroup aggression leads to rejection of means but not goals.
- 2.4 Rejection of means constitutes delinquency.

From the foregoing sets of propositions it was concluded that the process of delinquency in male adolescents was a function of class position.

Within this framework a parallel set of auxiliary propositions were elaborated:

1. Success Goals

- (a) Middle-class adolescents strongly internalize the success goals.
- (b) Lower-class adolescents partially internalize the success goals.

2. Frustration of Legitimate Means

- (a) Some middle-class adolescents are frustrated in their attempts to develop legitimate means abilities.
- (b) Many lower-class adolescents are frustrated in their attempts to develop legitimate means abilities.

3. Availability of Class-Linked Illegitimate Opportunity Structures: Frustration of Illegitimate Means

- (a) Middle-class adolescents have no opportunity to utilize the illegitimate avenue of white collar crime.
- (b) Lower-class adolescents have little opportunity of being recruited into the ranks of professional thieves and organized crime.

Inability to use effectively either the legitimate or illegitimate opportunity structures leads to status-frustration. Status-frustration leads to middle-class ingroup aggression and to lower class outgroup aggression.

4. Modes of Aggressive Expression

- (a) Middle-class ingroup aggression leads to rejection of middle-class means but not goal values.
- (b) Lower-class outgroup aggression leads to rejection of middle-class means and goal values (i.e., the middle-class value system in general including institutions and persons embodying and representing the value system).

Rejection of means but not goal values leads to rejection of means but not goals which constitutes delinquency involving property acquisition. Rejection of means and goal values leads to rejection of means and goals which constitutes delinquency involving aggression or aggressive intent against persons, public disorder and destruction of property.

On the basis of the foregoing theoretical framework, specific hypotheses regarding rates of arrest and proportional distribution of types of offenses among middle and lower-class delinquents respectively were formulated.

In the research that followed the hypothesis regarding differential rates of arrest by class was confirmed. The hypotheses regarding distribution of types of offenses by social class, however, were confirmed only in the case of destruction of property and of acquisition of property for the early adolescent period. An unanticipated finding was the significance of the age factor in the distribution of types of offenses. Some possible explanations for the findings are presented in the concluding remarks.

In general, the findings suggest a need for modification of the theoretical framework to take into account the significance of the age factor and the fact that crimes involving public disorder and aggression or aggressive intent against persons are similarly distributed among middle and lower-class adolescent delinquents, respectively. In particular, it may be important that the theory involves a recognition of differences between a new and an old middle-class group, the former retaining many characteristics of the lower-class group including outgroup aggression toward the old middle-class. These and other implications of the findings are presented in the concluding remarks.

Microfilm \$3.05; Xerox \$10.60. 235 pages.

THE SYSTEM OF CONTROLLED DECENTRALIZATION OF THE CATHOLIC CHURCH

(Order No. Mic 61-1022)

Reverend Joseph M. Nguyen-Hieu Hoc, Ph.D.
Stanford University, 1961

I. Problem

This is a study to test Selznick's theory of decentralization and social integration which maintains that

decentralization is possible only in the later stages of institutional development of an organization. Selznick maintains that extensive delegation of responsibility and decision-making to lower echelons requires a preparatory period of training under central leadership in order to create homogeneity of personnel and a unified outlook, before decentralization is feasible.¹

This theory has been tested against the history of the Catholic Church, viewed as a temporal organization, and studied at two stages of local institutional development, in Viet-Nam and in the United States. Viet-Nam at the early stages of its Christianity, 1615-1679, was an internally divided country of homogeneous population with a farming economy in a tropical climate, ruled by an hereditary monarch. The United States at its later stage of the Catholic Church, 1875-1960, in the late Nineteenth and Twentieth Century, is a democratic society with a heterogeneous population and an industrial economy, organized as a democratic Republic.

If the Selznick theory held true, we would expect that the Catholic Church would apply centralization in Viet-Nam of that period, and decentralization in the United States.

II. Methodology

It is a question of determining the character of the chain of command within the Catholic Church. It leads therefore to a study of the mechanism of control and communication between the central and local governments of the Catholic Church. Consequently, the two sociological concepts of control and communication have been used for analyzing this kind of administrative relationship. If the controls are light, leaving room for initiative and responsibility of the local government; and if local leaders have means and occasions to exchange views and even to initiate policies that affect the planning of the top leadership, then we find decentralization.

III. Results

In the frame of reference of the Selznick theory, we have placed the practice of decentralization in the Catholic Church in an historical and evolutionary perspective both for the Church in Viet-Nam and in the United States, and we have found:

- 1) that decentralization was applied regardless of the stage of organizational development;
- 2) that decentralization was applied regardless of the condition of the homogeneity of the group itself, regardless of the condition of the homogeneity of the personnel and their personal outlook;
- 3) that the only requisite for decentralization was training of personnel. However, while training, in Selznick's view, is aimed at homogeneity, the system of indoctrination in the Catholic Church is oriented toward the formation of leaders, held together by unity of doctrine and by self-discipline rather than by a formal system of control.

IV. Conclusions

The Selznick theory of stages of organizational development and decentralization is not valid as a "general theory of formal organization" applicable to such a corporate organization as a church. It contains, however, a great deal of truth in the importance of training required for decentralization. A theory of decentralization,

applicable to any formal organization, presupposes the existence, the formation or the development of

- 1) a group of qualified and devoted leaders
- 2) a unity of doctrine
- 3) a system of control and communication

1. Philip Selznick, Leadership in Administration, Evanston, Ill.: Row, Peterson & Co., 1957, pp. 113-118; also TVA and the Grass Roots, Berkeley, Calif.: Univ. of Calif. Press, 1949, pp. 42-44.

Microfilm \$2.75; Xerox \$9.00. 197 pages.

THE PROFESSIONALIZATION OF LAW STUDENTS: A STUDY IN FACET DESIGN.

(Order No. Mic 61-1023)

Jan McDonald Howard, Ph.D.
Stanford University, 1961

This research has three independent, yet interrelated, purposes: to explore conceptually the decision making (situational) contexts in which a lawyer participates; to test a methodology for handling multi-dimensional variables; and to measure and compare the attachment of Stanford freshman, junior, and senior law students to a particular set of status values.

Selected constructs deemed symbolic of aspects of a practicing attorney's perceptual world served as measures of the law students' status values. The conceptual exploration of a lawyer's decision making set, the translation of these constructs into operational form, and the analysis of the product of their empirical testing were all made feasible through the technique of facet design—a relatively new methodology (originated by Louis Guttman) for handling multi-dimensional variables.

The dissertation consists of eight chapters: Chapter I, the Introduction, discusses the independence and interdependence of the research goals; Chapter II is concerned with the "theory of facets" (with some of the assumptions underlying facet design as a research technique, with a few examples of earlier research based upon it, and with some of the major similarities and differences between the law student study and these earlier projects); Chapter III focuses upon the conceptual analysis of a lawyer's decision making situation (the spinning of the conceptual model for the law student study); Chapter IV is concerned with the empirical design for handling this particular set of multi-dimensional variables (with constructing and administering the test instrument); Chapter V discusses the procedure for analyzing the substantive data; Chapter VI summarizes the value preferences of the Stanford Law School student body as a whole with respect to a particular set of 32 value contrasts; Chapter VII focuses upon the inter-class (i.e., freshman-junior-senior) similarities and differences in value preferences with respect to the same set of 32 value contrasts; and Chapter VIII is devoted to general conclusions and research suggestions.

Among the law student values under scrutiny are the following: commitment to occupationally relevant rewards versus commitment to non occupationally relevant rewards; commitment to lawyers as a reference group versus

commitment to non lawyers as a reference group; relative attachment to various social reward bearing status groups; altruism (helping client) versus egotism (helping self); relative attachment to helping clients of various statuses; relative attachment to various rewards for self (e.g., attachment to cognitive rewards for self versus attachment to economic rewards for self, attachment to deference rewards for self versus attachment to affective rewards for self, etc.); relative attachment to various rewards for client.

Of the 32 value preferences of the student body as a whole, 24 are statistically significant. But the inter-class analysis shows that in only 5 out of the 32 value contrasts is there a statistically significant value shift over time in law school.

These findings have implications for the professional ideal and for an understanding of the professionalization process. Microfilm \$8.80; Xerox \$31.50. 696 pages.

**A SEARCH FOR FUNCTIONAL UNITIES:
AN ANALYSIS OF UNITED STATES
COUNTY DATA.**

(Order No. Mic 61-2585)

Glenn Hays Johnson, Ph.D.
New York University, 1958

Adviser: E. F. Borgatta

Seventy-two variables including information on population composition, vital processes, marital status, education, labor force composition, family income, commercial activity, agriculture, housing, climate, and spatial isolation descriptive of a random selection of 370 counties in 1950 were intercorrelated. The resulting matrix was factor analyzed using Thurstone's complete centroid method and orthogonally rotated to apparent simple structure. Six factors accounted for 100 percent of the variance. Since the first factor, population size, accounted for 60 percent of the variance and might thus mask relationships of the variables to secondary factors, it was decided to convert all of the data not in rate form to per capita rates and re-analyze. This involved 44 variables. A second intercorrelation matrix was computed and a preliminary cluster analysis done to determine which of the 72 variables were most appropriate to retain for further analysis. Forty-five were selected for a second factor analysis. Nine factors were extracted and five retained as substantial after orthogonal rotation. These five accounted for 60 percent of the variance in the second analysis and clearly replicated the results of the initial study.

Factor 1 represents size of population. It accounts for 94 percent of the variance in variables expressed as enumeration totals and 12 percent of the variance in those expressed as rates in the initial study. Total population has perfect saturation.

Factor 2 represents a nonfarm, urban-rurban monetary economy reflected in a relatively high level of living. This can be viewed as essentially a socio-economic or level of living factor which is associated with population, which in turn is the primary definition of urban. This is best defined by high family income, a high proportion of

the population nonfarm, many multiple dwellings, high value of one family homes, and a high proportion of dwellings having hot running water and adequate bathrooms.

Factor 3 represents a 20th century prosperous adaptation of 19th century family farming and finds its most conspicuous expression in the Midwestern Corn Belt. This is best defined by a cool, dry climate, a high farm-operator family level-of-living index, considerable revenue from sale of livestock, high farm capitalization, a high sex ratio, and a demographically stable population structure.

Factor 4 represents age of the population. It points to the conclusion that the age structure of each side of the population pyramid must be included in any adequate description of a population. This is best defined by a high median age of the population, few persons per dwelling unit, and a high death rate.

Factor 5 represents a stability or incipient decline factor that is most sharply marked by the absence of residential mobility and absence of new home construction.

Factor 6 represents industrialized or commercialized farming vs. subsistence farming. This may also be basically an agricultural climax factor. If the component reflecting successful farming is shifted to Factor 3 by further rotation, this becomes a tenant farming vs. subsistence farming syndrome. The principal variables indicate a low proportion of owner occupied dwellings and a high percentage of tenant operated farms.

Factor scores were computed for both sets of factors and a county typology constructed which indicates definite regional gradients. The South was sharply etched by low scores. Two-thirds of the counties are represented by three county types.

Thirty-four tables and sixteen illustrations are included. Microfilm \$2.90; Xerox \$10.15. 222 pages.

**AN EMPIRICAL TYPOLOGY
FOR URBAN DESCRIPTION**

(Order No. Mic 61-2628)

Howard Bernard Kaplan, Ph.D.
New York University, 1958

Adviser: E. F. Borgatta

A review of the literature on urban phenomena indicated that this area lacked a general theoretical framework and encompassed but few systematic empirical studies which integrated large portions of the available data. With this fact in mind, it was proposed that available data should be systematically treated in an attempt to derive stable variables which could be used as basic explanatory factors and as the criteria for an empirical typology for urban description.

To this end, two factor analyses of thirty-two and forty-seven variables respectively were executed. The data were randomly selected for a sample of 370 cities of twenty-five thousand and over. The variables chosen represented a sample of the data available for the study of urban phenomena.

The analyses were executed by means of Thurstone's complete centroid method and the extracted factors were rotated to apparent orthogonal simple structure. The first

analysis yielded five factors which accounted for approximately 70 per cent of the mean variance. The second analysis yielded four factors which accounted for a mean variance of approximately 60 per cent. When the two analyses were compared it was found that four of the factors were common to both analyses, and that one factor was unique to the first analysis. The unique factor was primarily a result of the use of total numbers rather than rate data for some of the variables in the first analysis.

The five different common factors were interpreted by an examination of the correlations of the variables with the factors. The first factor was interpreted as population size. The second factor was interpreted as a socio-economic dimension. The third factor concerned population stability and growth. The fourth factor contained components of ethnic and racial homogeneity as well as residential orientation. Finally, the fifth factor was interpreted in terms of the age-sex structure of the cities.

To facilitate the use of the derived factors in research, a test was constructed for each factor. Each city was assigned a score along each dimension. The final stage in the construction of the typology consisted of placing cities in the upper or lower halves of the distributions of test scores for each factor. The end results of the process were thirty-two clusters of cities that were homogeneous with respect to factor pattern type.

In conclusion, since the five derived factors accounted for most of the variation of the original characteristics, these dimensions were tentatively understood to be fundamental explanatory variables that could be useful in the development of a theoretical system. Moreover, in order to further systematic inquiry into the nature of the urban structure, these factors were used as the basis for an empirical typology for urban description.

Microfilm \$2.75; Xerox \$9.45. 207 pages.

A SOCIOLOGICAL ANALYSIS OF VOCATIONAL COUNSELING

(Order No. Mic 61-1064)

Robert Perry Overs, Ph.D.
The University of Buffalo, 1961

This is an attempt to apply the methods of sociological analysis to the profession of vocational counseling. In scope, it falls primarily in the field of occupational sociology. In method, it is an exploratory study at the conceptual level. The initial phase of the study is an examination of the chief concepts available for the guidance of practitioners as found in the vocational counseling literature. The number, distribution and professional affiliations of vocational counselors is indicated. The informal system is considered with a discussion of the myths, status, ritual and related aspects of the occupation. It is concluded that vocational counseling is a rapidly changing occupation as it seeks to gain the recognition of full professional status. Stresses, strains and conflicts are associated with the rapidly changing role. Debate ranges over the direction in which the profession should move and the duties which should be added or dropped.

The remainder of the study is concerned with the interaction of vocational counseling with the larger societal

system. The functional role of vocational counseling is discussed, drawing heavily on the work of Hughes and Parsons. The role of the counselor as actor is contrasted with the role of the client as actor. This dichotomy is compared with the physician-patient dyad. The mandate claimed by the profession is examined and the nature of the license granted to it by society. Problems involved are the handling of guilty knowledge, the use of time, the question of exploitation and magic and certain role limitations such as prediction without control as well as lack of control.

In considering the interaction of vocational counseling and the economic system, the concepts held by vocational counseling and labor economics are contrasted. Sharp conflict at many points is found between these two conceptual systems. In practice, much of the work of vocational counselors with individual clients is negated by policies stemming from a different conceptual system. Psychological and philosophical bases are different, as is the way in which unemployment is viewed. Forecasts of manpower needs are considered differently. Neither conceptual system claims a mandate to evaluate either the usefulness of the occupation entered or the usefulness of the goods and services produced. Other vested interests in vocational choice are considered.

An analysis of vocational rehabilitation counseling reveals even more sharply underlying stress and strain in the social system. A paradigm was constructed to clarify the interrelationships among marginal, spuriously marginal and occupationally handicapped workers. Since vocational rehabilitation counseling is the most recent counseling specialty, resolving some of these conceptual paradoxes is of current practical urgency for its future development.

The structure of determining factors affecting occupational choice is examined. The increasing rigidity of the educational and occupational structure is a significant pattern and the impact of this has been discussed. Social change is studied both from the view of the impact of social change on vocational counseling and also the possible contributions of vocational counseling to social change. The place of technological change is appraised. Vocational counseling appears to be of little import in influencing either planned or unplanned social change. A general conservative bias is obvious; vocational counseling supports the status quo.

Finally, a forecast of future developments is attempted. The direction of future events will be determined by a resolution of a power struggle within the profession. The structural role will change with the addition or deletion of certain activities from the occupational bundle. The function performed will change accordingly with repercussions in the status of the profession and the way society views it generally.

Microfilm \$2.75; Xerox \$9.00. 196 pages.

SOCIAL PARTICIPATION IN
BEAUPORT, PROVINCE OF QUEBEC.

(Order No. Mic 61-2220)

Simone Paré, D.S.W.
Columbia University, 1961

This dissertation is based on a study of social participation conducted in 1957-58 at Beauport, a residential suburban town of the Province of Quebec, Canada.

A random sample of one hundred informants, male and female, over fifteen years of age, was selected from the total population of 6,735, and these persons were visited in their homes. In addition, twenty-nine presidents or other officers representing some thirty-five voluntary associations operating in Beauport were also contacted.

The dissertation discusses the following points: the use of spare time of the population of Beauport; the types of groups or associations which are offered to that population; the types of groups (primary or secondary) for which these individuals show the greatest interest and the reasons accounting for this preference; the degree of participation of the informants in primary and secondary groups; the motives of participation or lack of it in primary and secondary groups; the perception, understanding and degree of knowledge of the leadership, structures, aims and activities of the voluntary associations by the members and the leaders; the possible changes and modifications in the direction, structures and programs of the voluntary groups, in order to promote a better participation of the members and to fulfill their aspirations; the conditions under which principles and practices of social group work and community organization could be applied and used in French-Canadian communities.

The dissertation comes to the following conclusions:

- As to the number of memberships in voluntary associations, 59.4 percent of the women in Beauport, as against 18.8 percent of the men, have no membership in voluntary associations and 60.0 percent of the sons, as against one third of the daughters, have similarly not joined any secondary group.

- A proportion of 61.5 percent of the women, as against 53.8 percent of the men, never attend or attend only occasionally the meetings of secondary organizations; one third of the sons who have joined at least one voluntary association participate irregularly in its meetings, as against 57.1 percent of the daughters who display the same behavior.

- The only types of secondary groups which the women in Beauport join are the religious and charitable ones. With respect to the members of the second generation, the daughters tend to register in greater numbers with religious and charitable associations than the sons. Both the sons and the daughters are more assiduous in their attendance to the meetings of educational-recreational associations than to those of other types of secondary groups. The educational-recreational organizations and the sports groups obtain the highest assiduity and the most active interest on the part of their members, either men, sons or daughters, the sons being more numerous than the men and daughters in these kinds of associations.

- As to the participation of the informants in primary groups, the men and women have more kinship reunions and spend more evenings with their residential family than

do the sons and daughters. However, the difference of sex and the participation in primary groups exert no significant influence on the degree or extent of participation of the men and women who have joined one or more voluntary associations. The sons and daughters in general have more friendship reunions than the men and women. The members of the second generation who tend to register more with voluntary associations are those who have more family and kinship reunions. The daughters have a weaker participation in their secondary groups but both sons and daughters who have a more regular participation tend to be found among those who have less contacts with their family and kin groups.

Microfilm \$7.10; Xerox \$25.20. 559 pages.

THE STUDY OF THE ORIGINS,
EDUCATION AND OCCUPATIONAL
DEFINITION OF HOTEL MANAGERS
AS RELATED TO CAREER PATTERNS
OF SECURITY AND SUCCESS.

(Order No. Mic 61-2712)

Wesley Irvin Schmidt, Ed.D.
Michigan State University, 1961

Major Professor: Walter F. Johnson

There is need in current social science for studies of mobility within the life spans and occupational histories, not only of the typical, but of the more and less successful worker. Most previous investigations of managers and executives have studied them as a broad class without regard to the particular nature of their industries. Moreover, these studies have viewed success as the achievement of a certain level of management, rather than by differential criteria of success within that occupational level.

The present study is a search for formal and informal factors in the career patterns of hotel managers. This longitudinal study is focused on such variables as social origin, education, sponsorship, occupational definition, and mobility patterns as they relate to several criteria of success.

A random sample, stratified by number of hotel rooms, was selected from four midwestern states. Sixty operating managers, representing hotels of all sizes from the membership of the American Hotel Association, were interviewed. Twenty interviews were conducted within each size classification--small, medium and large hotels.

The method chosen for studying the subjects was the anonymous, retrospective, personal interview. The interview schedules were developed and standardized in a pilot study.

The criteria of success are identified according to the number of years required to reach the first top management position, personal income, occupational security, size of hotel, hotel quality ranking, and the business activity index.

The major findings and conclusions are as follows:

- The socio-economic origin of this sample of hotel managers is superior to that of managers in

general, even as contrasted with the executive elite. Those of the proprietary heritage were less likely to achieve the essential attributes leading to success; namely, sponsorship and an "executive" occupational definition.

2. There is a significant relationship between years of formal education and a rapid rise to the operating managers position.

3. Formal education and "sponsorship" were found to be significantly related.

4. The search for an executive versus a lower level self-image in the definition of occupation uncovered three differentials: the executive, fitting the accepted administrative role; the operator, having a production, facility, and guest orientation; the greeter, assuming the classic "grand host" stereotype.

5. The proportion of managers who defined themselves as "executive" managers and who possessed a collegiate background was not significantly different from the non-graduates. Neither did college graduates distinguish themselves to a significant degree as leaders in civic or hotel organizations.

6. The use of continuing education is related to evidences of a positive attitude toward learning, personal growth, new ideas and the future of the hotel business. Those managers pursuing continuing education adopt the "executive" view of hotel management to a significantly greater degree than others. Continuing education is not significantly related to formal education, the proprietary heritage or sponsorship.

7. Two factors were identified as deterrents to participation in continuing education programs and to a greater development of the "executive" definition--the apprenticeship philosophy toward the management trainee and the low level of management security which pervades the industry.

8. Sponsorship, the initial and/or career-long association of a key hotel manager and his protege, is identified as one of two keys to success in hotel management. Sponsored managers tend to develop an "executive" definition, rise more rapidly and "consistently" to the top, and are found in better hotels doing an above average business.

9. "Executive" hotelmen are associated with larger hotels, with higher quality hotels (regardless of size), with hotel chains, with more secure careers, with higher personal incomes, and with positions of leadership in civic, fraternal, and hotel related organizations.

10. Hotel managers' careers are found to be less secure than those of managers in general industry. The percentage of managers found in the less stable career categories approximates the general industry pattern of the semi-skilled and operatives.

11. Hotel management is apparently closed to managerial migration from unrelated industries.

Microfilm \$2.95; Xerox \$10.35. 226 pages.

SOCIOLOGY, PUBLIC WELFARE

INTERNATIONAL STUDENTS IN EDUCATION FOR SOCIAL WORK: AN ASSESSMENT OF THE EDUCATIONAL EXPERIENCE BY INTERNATIONAL GRADUATES OF SCHOOLS OF SOCIAL WORK IN NORTH AMERICA, 1948-1957.

(Order No. Mic 61-1083)

Kenneth Murase, D.S.W.
Columbia University, 1961

This study seeks to assess the relevance of social work education in North America to international students, particularly those from underdeveloped countries. The central issue is whether or not professional training in social work which is geared primarily to the needs of an urban industrial society is relevant to the needs of essentially rural, agricultural societies.

The study population consisted of all international graduates of all schools of social work in the United States and Canada, for the period 1948 through 1957. The study sample consisted of 225 respondents out of 272 graduates, who were known or presumed to have returned to their countries of origin, to whom questionnaires were mailed. Data was sought on selected aspects of their background, their educational experience, their post-return careers, and their perceptions of the utility of their professional training in North America.

The distribution of respondents was as follows: Asia, 37 per cent; Europe, 22 per cent; Middle East, 15 per cent; Africa, 14 per cent; Latin America, 9 per cent; and Oceania, 3 per cent. In their first employment the largest proportion of respondents were found engaged in the field of social work education, followed by the health services, family and child welfare, and leisure time services as other major fields of employment. Graduates from developed countries tended to perform direct service roles in their first employment; those from less developed countries tended to perform non-direct service functions--teaching, administration, research, and consultation.

Proportionately the least difficulty in the transfer of learning, and the greatest satisfaction with the over-all educational experience were reported by those who were (a) from relatively developed countries, (b) sponsored by a governmental agency, (c) 30 years of age or over at time of graduation, (d) experienced in social work in their own countries, (e) specialized in the casework method, (f) rated as superior academically, and (g) employed for five years or more after graduation.

The findings indicate that the educational objective of students from the developed countries calls for a program of concentration in specialized knowledge and technical skills. For students from underdeveloped countries, the educational objective should be the acquisition of competence in the processes related to the establishment of social welfare policy and services, i.e., social welfare planning, financing, administration, training, and research.

More than three-fourths of all international students now originate from underdeveloped countries. Their salient objective is to contribute to the social development of their countries. Emphasis is therefore required in the areas of (1) social welfare policy and services, (2) social welfare administration, (3) community welfare planning, (4) social science theory, (5) social research. Adaptations

suggested for modification in field work include (1) placement in a setting to provide learning in more than one method, (2) multiple short-term placements for exposure to a variety of programs and methods, (3) placement in a setting to simulate conditions in the home country, and (4) supplementation of field work by a program of planned observation visits to community agencies.

The general objectives for international students are found to be consonant with the objectives set forth for all

students in the curriculum study of the Council on Social Work Education--namely, (1) a broadened conception of the social welfare function, (2) an expanded and unified base of theory which incorporates relevant aspects of both the behavioral and social sciences, and (3) an emphasis upon preparation for future responsibilities of professional leadership in the social welfare field.

Microfilm \$4.75; Xerox \$16.90. 371 pages.

S P E E C H — T H E A T E R

CLEVELAND THEATRE IN THE TWENTIES (Order No. Mic 61-2823)

Irving Marsan Brown, Ph.D.
The Ohio State University, 1961

The need to understand the development of the American theatre in the twentieth century can be fully met only when detailed analyses of its growth are forthcoming. This study attempts to fill part of that need by an examination of the depth and breadth of the dramatic activities of the population of Cleveland, Ohio, during the period 1919-1929. The core of the study has been the inspection of each issue of the Cleveland Plain Dealer published during the period. Supplementary materials were acquired through the perusal of other Cleveland periodicals and of books and articles concerning Cleveland; from play programs, announcements, and brochures; and by interviews with persons active in Cleveland drama during the twenties. The evidence obtained from these materials confirms earlier conclusions regarding the changes in the commercial theatre during the period—a decrease in the number of road shows, the resurgence of the resident stock companies, and the tendency toward longer runs—and reveals the surging growth of amateur dramatic activities, growth not only in the production of plays but in drama study groups, formal courses in drama, lectures, dramatic readings, tableaux and pageants, and growth in the number and kinds of agencies concerned with drama: colleges and universities, women's clubs, girls' groups, settlement houses, church groups, drama schools, private and public schools, and nationality groups. The principal conclusion of the study is that an outstanding contribution of the twenties to the growth of American drama was the familiarization of a great and new section of the population with the nature and value of the dramatic arts. This education was a necessary preliminary to the development of the community theatres, which took place in the years that followed the twenties, as well as a source of support, however dwindling, of the commercial theatre in its battle for existence against the radio and motion pictures.

Microfilm \$2.85; Xerox \$9.90. 220 pages.

THE HISTORY AND PROGRAMMING POLICIES OF RIAS: RADIO IN THE AMERICAN SECTOR (OF BERLIN).

(Order No. Mic 61-2737)
Donald Roger Browne, Ph.D.
University of Michigan, 1961

The purpose of this study was to outline the history, analyze the working structure, and assess the extent and nature of the success of an international broadcasting station. RIAS is not necessarily "typical" of international broadcasting stations; however, much of its methodology and many of its experiences in broadcasting to its primary "target" area, Communist East Germany, might well be applicable on a wider scale.

RIAS was founded by the American Military Government in February, 1946. It was originally intended to inform and entertain the Germans in the American sector of Berlin; it utilized the German language and programmed to German tastes. As relations between the United States and the Soviet Union worsened, however, the station began to broadcast programs which attacked Soviet policies, and especially the Blockade of West Berlin in 1948-49. In May, 1949, the station initiated programming which was designed specifically for the people of Communist East Germany. Within a year, RIAS was following a policy of serving the East Germans as "the sort of radio station they would want if they were allowed any choice in the matter." This meant attacking the East German government and aiding, informing, and entertaining the East German people.

Following the 1953 East German Uprising, however, the East German government consolidated its power, while simultaneously granting concessions to the East German people. Consequently, the people began to seek a modus vivendi with the regime. RIAS, therefore, began to stress the idea that the West had not "written off" East Germany to the Communists, and that East Germany shared a common heritage with West Germany and the Western world. It is this policy that has been predominant in the RIAS broadcasts from 1953 to the present.

In order to analyze the working structure of RIAS, the author visited the station in June, 1960. The main findings were these:

1. Although RIAS is supervised by the United States Information Agency and the United States State Department, it has considerable autonomy, enabling it to respond quickly to most events.

2. The eight-man American staff which supervises the 475 German employees of RIAS leaves the day-to-day operation of the station to the German staff. The American staff sees to it that RIAS reflects American policy; otherwise, the station is largely a German operation.

3. The cooperativeness, intelligence, high morale, and sense of dedication which exist in the entire RIAS staff seem to have made the station a highly efficient organization.

On the basis of an examination of RIAS program schedules and broadcasts, interviews with staff members, letters from East Germans, and available reports of surveys (taken in West Berlin) of East German opinions on RIAS, the author sought to assess the nature and extent of the success of RIAS in broadcasting to East Germany. Some of the more important conclusions were these:

1. RIAS is listened to regularly by perhaps sixty per cent of the East Germans, who think of it as a German station, and consider it to be trustworthy, accurate, timely, and considerate of their needs and desires.

2. RIAS has often been able to aid the East Germans, both individually and collectively.

3. Many East Germans consider RIAS to be the best information source for news about East Germany, but think of it as only one of many information sources on life in the West.

RIAS seems to have been successful in reaching the East German people. Although many of the factors which appear to contribute to the success of RIAS would have little wider application, other factors such as timeliness, consideration, accuracy, and, above all, trustworthiness, could well serve as models for all international broadcasting operations.

Microfilm \$4.80; Xerox \$17.10. 376 pages.

RENÉ BARY'S RHÉTORIQUE FRANÇOISE

(Order No. Mic 61-2325)

Mitchell Roy Burkowsky, Ph.D.
Wayne State University, 1960

Adviser: George Bohman

The purpose of this study is to reawaken rhetorical interest in the rhetorical works of René Bary, whose major rhetorical text, La Rhétorique françoise, appeared in at least five editions (1653, 1659, 1665, 1669, and 1673). For over twenty years this heavily Aristotelian book was recommended highly to those who were interested in eloquence. This may have been due in part to a resurgence of interest in Aristotle after a long period of ascendancy of the rhetorical philosophies of Quintilian and Cicero, who were the most read of the classical rhetoricians in seventeenth century France. Again, Bary's prominent position as historiographer and advisor to Louis the Fourteenth may have helped in the sale of his books. The latter concept may be substantiated somewhat by the

preface to the 1659 version, which preface was written by the Sieur des Herminières, President of the Parlement of Paris, Substitute for the Procuror-General, and Advisor to the King. The glowing, almost resplendent praise heaped upon Bary by the Sieur des Herminières contains a few statements which indicate that the preface-writer had not read the book prior to or after having written the preface.

La Rhétorique françoise contains many whole sections which have been taken almost verbatim from the first two books of Aristotle's Rhetoric. Even several examples have been borrowed to accompany the theory but Bary has openly acknowledged Aristotle to be the major source of the first two parts of La Rhétorique françoise. The third and last section on language usage and style leans heavily on the works of Vaugelas and Dupleix, two seventeenth century arbiters of literary and linguistic style. Voice and gesture are all but ignored in this book, the major emphases being invention, disposition, and style.

Microfilm \$5.65; Xerox \$20.05. 442 pages.

SOME ACOUSTIC CHARACTERISTICS OF THE SPEECH OF PROFOUNDLY DEAF INDIVIDUALS

(Order No. Mic 61-1015)

Donald Raymond Calvert, Ph.D.
Stanford University, 1961

Development of acceptable speech for profoundly deaf individuals is a major problem in education of the deaf. Considerable effort has been expended toward improving techniques for speech development but relatively little research has been performed to determine acoustic features of deaf speech. Certain speech signal characteristics which may lead to identification of speakers as being deaf can be examined through acoustic analysis. This study endeavors to answer the following questions:

1. Are durational characteristics of plosive consonants and their vowel environments, when uttered by deaf speakers, different from those of normal-hearing speakers? If so, how do they differ?
2. Are durational characteristics of fricative consonants and their vowel environments, when uttered by deaf speakers, different from those of normal-hearing speakers? If so, how do they differ?
3. Are vowel formant band positions of deaf speakers different from those of normal-hearing speakers? If so, how do they differ?
4. Are vowel formant band widths of deaf speakers different from those of normal-hearing speakers? If so, how do they differ?

Procedures

A preliminary investigation was conducted to determine speech information levels necessary for listeners to identify speakers as being deaf. From the results of this investigation, bisyllabic nonsense words were selected for stimulus material.

A perceptual study was conducted to determine which samples of speech would be selected for acoustic analysis.

Samples were recorded by speakers who were deaf, normal, and who simulated deaf speech. Deaf and normal speakers ranged in age from fifteen-eighteen years. Samples were submitted to two groups of listeners. One group was asked to judge whether the speakers were deaf, normal, or simulating deaf voice. The other group was asked to transcribe the speech sounds heard in phonetic symbols. Samples were selected for analysis on the basis of agreement of judges within both groups.

Speech samples selected were submitted to acoustic analysis, using a Sonagraph as the principal instrument. The following acoustic features were examined:

1. Durational characteristics of phonemes
2. Vowel formant positions
3. Vowel formant band widths.

Results and Conclusions

Deaf speakers typically distort durations of vowels preceding and following plosive and fricative consonants by extending duration. They also distort fricatives and the closure period of plosives by extending duration and by not following expected durational differences as a function of the condition of voicing of the consonant. The typical durational interactions of speech sounds found for normal speakers were absent for deaf speakers. Durational distortion of deaf speakers is not the simple matter of making all sounds longer but involves distortions which tend to disrupt relational as well as absolute values and probably contribute significant cues for the identification of speakers as being deaf as well as interfering with intelligibility.

The durations of release periods of deaf plosives were within the range for normals and were closely associated with perceptions of the condition of voicing of the plosive. Perceptions of "surd-sonant" errors of deaf speakers were closely associated with durations of release periods.

The relative position and separation of the first three formants of the vowel [æ] were not different for deaf and normal speakers. However, the separation of fundamental frequency and first formant was typically less for deaf speakers than for normals. Since existing literature tends to link formant position to speaker identification, it seems possible that atypical separation of fundamental and first formant is a factor in the identification of speakers as deaf.

Formant band width was measured on formants of the vowel [æ]. There was a slight tendency for deaf speakers to have greater band width than normal speakers in this study. Microfilm \$2.75; Xerox \$6.40. 135 pages.

THE DEVELOPMENT AND EVALUATION OF TEACHING MACHINE PROCEDURES FOR INCREASING AUDITORY DISCRIMINATION SKILL IN CHILDREN WITH ARTICULATION DISORDERS

(Order No. Mic 61-1869)

Audrey Longridge Holland, Ph.D.
University of Pittsburgh, 1961

Three teaching machine programs were developed for teaching auditory discrimination for the (s) sound. The

programs were designed for use with a tape recorder modified to serve as a teaching machine. They were recorded on tape and presented, by the tape-recorder-teaching-machine, to three groups of nine (s) defective children each. Before receiving the programmed instruction, each child was given three speech sound discrimination tests and two articulation tests. Following the programmed instruction, all tests were repeated. The programs were evaluated by comparing the pre-program and the post-program test scores. The analysis showed one of the three programs to be capable of reliably improving the subject's discrimination for the (s) sound, their discrimination between sibilant sounds, and their (s) articulation. This program taught a wide range of (s) discriminations, and follows Margaret Hall Powers' outline for teaching speech sound discrimination. Another program reliably improved (s) articulation and sibilant discrimination. This program used only items consisting of isolated sounds. The third program reliably improved (s) articulation only. This program consisted of items requiring discrimination of correct from distorted production of (s) within words.

These results indicated that the teaching machine program which used a wide range of (s) discrimination tasks was a reliable method for improving the (s) discrimination ability of children with defective (s) articulation. The differences between the programs were discussed in terms of the nature of the tasks in each program, the reactions of the children to the programs, and in terms of principles of programming for teaching machines.

The study suggests that it would be possible to extend this method to the teaching of other sound discriminations, and perhaps to other areas of speech rehabilitation as well. Improvements in programming for discrimination training were suggested, some possible research problems were pointed out, and the implications of "automated speech correction" were discussed.

Microfilm \$2.75; Xerox \$5.80. 116 pages.

A PROMPTBOOK INVESTIGATION OF MACBETH PRODUCTIONS BY THE FOREMOST ENGLISH PRODUCERS FROM 1800 TO 1850

(Order No. Mic 61-2841)

Rudolph Edward Pugliese, Ph.D.
The Ohio State University, 1961

The dissertation is an investigation of six nineteenth-century promptbooks associated with English productions of *Macbeth* by John P. Kemble, Charles Macready, Samuel Phelps, and Charles Kean. The period in the analysis was the first half of the nineteenth century, 1800 to 1850, in which important developments were made in the theatre.

Throughout the study a comparison was made between the staging of Kemble and Macready who were more active during the first quarter of the century, and Phelps and Kean who dominated the theatre scene during the middle of the nineteenth century. The prompt notes revealed that Kemble and Macready were quite traditional in the staging and directing of this play. Phelps and Kean on the other

hand were definitely more modern in their approach, although they were nearly contemporaneous with the former pair.

All promptbooks were studied in a scene-by-scene analysis of the plays. Emphasis was given to scenic, staging, and directorial notes that revealed the techniques each manager used in production. Comparisons were frequently made to show the difference in the styles of directing. There was a significant difference between the traditional techniques of Kemble and Macready and the modern trends of Phelps and Kean.

Settings used in each scene have been carefully considered. This made it possible to envision the extent and scope of each production as well as the character of each. In general, it was revealed that elaborate scenery, lavish trappings, and extensive stage properties were used on a grand scale.

Major attention was also devoted to special effects. In a play that depended so heavily on witches and apparitions, considerable effort and imagination would have had to be expended to produce supernatural effects, weird atmospheres, and eerie arrivals and departures. Detailed instructions were recorded in the promptbooks for the execution of flying machines, trapped effects, misty scenes, songs and dances by witch choruses, and spirit ballets.

The first chapter discusses the influences wielded by Sir William Davenant and his contemporaries. The second chapter takes into account the authenticity and the nature of the promptbooks that constituted the basis for this research. Five chapters contain the analysis of each act and the methods used by the managers in productions. The final chapter is a summary.

Several floor plans taken from the promptbooks were used in association with set descriptions and prompt notes. Charles Kean's promptbook included eighteen watercolor designs of his sets used in the Macbeth production. These have been reproduced in black and white and included in the dissertation to supplement the text.

As a result of this research, it can be stated that Samuel Phelps and Charles Kean deserve recognition as two of the first modern directors in theatrical history. Their directorial techniques, which were the beginning of trends that are fundamental in contemporary dramatic production, instituted changes in the blocking of actors to produce better focus and composition; stressed ensemble acting among large crowds of actors onstage; included illusionistic settings; and made provisions for detailed instructions in the promptbooks.

Microfilm \$3.05; Xerox \$10.60. 233 pages.

RADIO BROADCASTING AT THE UNIVERSITY OF MICHIGAN, 1922-1958.

(Order No. Mic 61-2799)

William Bruce Stegath, Ph.D.
University of Michigan, 1961

This study is concerned with the collection and reporting of historical data about radio broadcasting at The University of Michigan. It has been almost entirely dependent upon primary source material: original documents and log-books, official University reports and correspondence,

scrap-books, contemporary news reports, and recollections of persons involved.

Broadcasting at The University of Michigan began with six Extension Lectures given over WWJ, Detroit in the spring of 1922. Interest lagged until 1924 when a laboratory station, WCBC, operated for a brief time from the campus. Denial of funds by the Regents for the continuous operation of WCBC forced its shutdown, and its license to broadcast expired in 1925.

In the fall of 1925, the University initiated a series of weekly, hour-long programs over WJR, Detroit, called "Michigan Nights." Immediately successful, the University continued the series until 1930 when programming on a daily basis was begun over WJR. In 1928, the Broadcasting Service moved from the first studios in old University Hall to renovated Morris Hall, signifying acceptance of broadcasting on the campus.

During the 1930's, the University's programming was broadened to include in-school broadcasts, adult education programs, and student-produced programs. Radio courses in broadcasting were begun in the Department of Speech in 1934.

By 1941, the need for additional time on the air prompted application for a license to operate an FM broadcasting station, which was to be part of an FM network in the state of Michigan. The FM network did not materialize, but WUOM, the University FM station began broadcasting in July, 1948.

In its ten years of operation, a quantitative analysis of WUOM programming reveals 60-75% of total program time devoted to music, almost all of which is serious, or classical, music. The remaining time is used for informational programs of all types, ranging from in-school broadcasts and lectures from the classroom to reports of sports events. The University of Michigan Broadcasting Service has won 14 awards for excellence of programs, and in 1958 had contributed 23 series of programs to the National Association of Broadcasters' tape network, more than any other station in the nation. WUOM has continued to supply programs to more than 75 commercial stations throughout the state of Michigan on a weekly basis.

The Appendix of the thesis contains photostats of the log-book entries for WCBC as well as photographs of the early days of broadcasting at Michigan. There is also a collection of recent photographs showing the WUOM facilities. Microfilm \$3.70; Xerox \$13.05. 387 pages.

RELATIONSHIPS BETWEEN CERTAIN MEASURES OF AUDITORY ABILITIES AND JUDGMENTS OF ARTICULATION PROFICIENCY

(Order No. Mic 61-1041)

Clyde LeRoy Stitt, Ph.D.
Stanford University, 1961

The purpose of this investigation was three-fold: (1) To develop a battery of group tests of auditory abilities which would provide adequate measures of discrimination and memory for speech signals, (2) to examine the relationships between certain measures of auditory abilities and judgments of articulation proficiency, and (3) to examine relationships between measures of auditory abilities and

articulation proficiency and measures of certain intellectual and language abilities derived from college entrance examinations.

Sixty-six native born college subjects, 47 monolingual and 19 bilingual, with normal hearing acuity and no demonstrable organic or neurological impairment recorded a standard prose passage, and highly reliable judgments of articulation proficiency were obtained from these speech samples. A battery of eight tests of auditory abilities was administered to these subjects and the data were intercorrelated. Entrance examination data, consisting of measures of college aptitude, vocabulary, verbal ability, reading ability, and spelling, were obtained for 55 of the subjects, 38 monolingual and 17 bilingual, and these measures were correlated with the measures of articulation and auditory abilities.

Four group tests of auditory abilities designed for this investigation consisted of a paper and pencil test of Subvocal Discrimination, which presumably called for discriminations among internally structured signals, and three tape recorded tests of Plosive Discrimination, Intraphonemic Consonant Discrimination, and Consonant Letter Memory Span. Other tests in the battery included the Seashore measures of Pitch, Tonal Memory, and Rhythm, and an individually administered test of auditory memory span for vowel sounds. The seven tests employing recorded acoustic stimuli were administered with a high quality playback system through matched monaural headsets.

The results are reported separately for the monolingual group, the total group, and each of three subgroups. Partial and multiple correlations are reported for the monolingual group. The results indicate that Articulation Proficiency is significantly related to the four measures of discrimination ability, to three measures of auditory memory, and to the entrance measures of college aptitude and language abilities. Significant relationships were found between the four measures of discrimination, between the two measures of memory for speech signals, between Tonal Memory and discrimination, and between Pitch and auditory memory. Through partial correlation technique, significant relationships were found between articulation and discrimination with auditory memory held constant and with various measures of language abilities held constant.

Examination of the magnitude of the squares of the beta coefficients, obtained in the multiple correlations, indicates that Subvocal Discrimination and Plosive Discrimination were the most effective of the measures of auditory abilities in accounting for variation in Articulation Proficiency. These two tests were highly reliable and significantly related to each of the entrance measures of college aptitude and language abilities. Both were also significantly related to Articulation Proficiency, when college aptitude was held constant.

It seems warranted to conclude that three of the new group tests -- Subvocal Discrimination, Plosive Discrimination, and Consonant Letter Memory Span -- are adequate measures of speech signal discrimination and memory and would appear to have clinical utility in assessing the auditory abilities of adult subjects. The results obtained in this investigation support the hypotheses that in normal hearing college students with no demonstrable organic or neurological impairment: (1) Articulation Proficiency is significantly related to discrimination ability, (2) Reliable measures of discrimination ability, employing different

types of signals and different testing techniques, are significantly interrelated, (3) Reliable measures of articulation and speech signal discrimination ability are significantly related to other language abilities, and (4) Articulation Proficiency is significantly related to discrimination ability even when measures of auditory memory, college aptitude, or entrance measures of language abilities are held constant. Microfilm \$2.75; Xerox \$8.60. 189 pages.

A SURVEY OF EXTANT GREEK THEATRES:
600 B.C.—133 B.C.

(Order No. Mic 61-1274)

Irene Christina Tsioris, Ph.D.
University of Denver, 1961

This study presents in encyclopedic form a listing of the extant Greek theatres erected during the Archaic, Classic, and Hellenistic periods. It includes information concerning the location and date of construction of each theatre, a description of the present condition of the theatre, and general information concerning the original structure and the alterations and additions which have been made during the course of history. Each entry includes the authoritative sources of information used in preparing it for inclusion in this survey.

In developing this study, the following sources of information were used: general theatre histories, theatre histories dealing principally with the classical theatre, histories of art and architecture, reports of archeologists, conjectures and assumptions of classical scholars, and personal surveys of the remains by the author.

This study includes an examination of sixty-nine theatres. The period of time covered by this study extends from the Archaic period to the end of the Hellenistic period. The inclusive dates are 600 B.C. to the middle of the first century B.C. In the Archaic period (600 B.C. to 500 B.C.) the only theatre extant is that in Athens. The theatres of the Classic period (500 B.C. to 300 B.C.) are those at Epidavros, Korinth, Megalopolis, Messini, Ephesus, Cyzicus, Tegea, Nemea, Eretria, Miletos, Babylon, Delphi, Dodona, Pompeii, Priene, Thorikos, and Syracuse. The theatres of the Hellenistic period (300 B.C. to 133 B.C.) are those at Durazzo, Kallatis, Mykenae, Sikyon, Thugga, Delos, Nemi, Teos, Bouthrotum, Olbia, Gortyn, Dourion, Samothrace, Troy, Amman, Anazarba, Assos, Bodroum, Thira, Magnesia, Mantinea, New Pleuron, Oiniadae, Oropos, Pergamon, Philippi, Piraeus, and Segesta. The theatres that cannot be dated are those at Antioch, Isthmos, Korkyra, Dion, Santorina, Marseilles, Trieste, Phoenike, Notion, Aegira, Kos, Alabanda, Salihye, Smyrna, Olympia, Orange, Taormina, Tyndaris, Thassos, and Ostia.

The theatre structures included in this study are only those originally erected during this period. They comprise not only those structures now located in Greece but also those found in other countries of the Mediterranean world.

Microfilm \$2.95; Xerox \$10.35. 226 pages.

A BIOGRAPHICAL AND DESCRIPTIVE
STUDY OF THE SPEAKING CAREER
OF EDGAR DEWITT JONES

(Order No. Mic 61-2811)

Gordon Glenn Zimmerman, Ph.D.
University of Michigan, 1961

Edgar DeWitt Jones, a protestant clergyman during the first half of the twentieth century, was one of the international figures of the Disciples of Christ brotherhood. He was widely known through his lectures, sermons, publications, and his participation in the ecumenical movement.

This study is designed in terms of four objectives. The first of these is to describe people and events that possibly influenced the practice and theory of public speaking of Jones. The second objective is to discover those personal qualities, interests, and speech practices which appear to have a relationship to his national reputation as a preacher and lecturer. The third aim is to describe the characteristics of oratory which Jones believed necessary for effective public speech. The fourth and final purpose of the dissertation is to present a comprehensive analysis of his theory of homiletics through a study of what he wrote and said concerning the art of preaching.

Data were obtained from personal interviews with both Jones and many of his friends and acquaintances, from newspaper and magazine articles, from his books, and from much unpublished material, including lecture notes on homiletics which he used at the Pacific School of Religion.

The entire career of Edgar DeWitt Jones was spent in the active pastorate of four parishes. He stayed for two years in his first church which was started in the fall of 1901 as the result of a series of evangelistic meetings which he conducted in Erlanger, Kentucky. The second congregation Jones ministered to was the Franklin Church of Christ in Cleveland, Ohio, where he stayed three years. The third parish Jones served was the First Christian

Church in Bloomington, Illinois, where he spent fourteen years. While in Bloomington he developed his interests in two of his favorite hobbies, ornithology and Lincolniana. Jones made his final move in 1920 when he accepted the challenge of building a new city church in Detroit, Michigan. This ambition was finally realized when the Central Woodward Christian Church was dedicated in 1928.

Other activities of Jones which enhanced his national reputation were the offices he held in his own denomination and his presidency in 1937 of the Federal Council of Churches. In addition, he lectured extensively, wrote twenty books, numerous monographs, many newspaper articles, and from 1939 to 1949 a daily syndicated newspaper column entitled "Successful Living."

Special conclusions from this study concerning public speaking are as follows: (1) the experiences of Jones as a youth helped to direct him into his career as a preacher; (2) he strongly advocated learning from the speech practices of others; (3) his national reputation as a speaker was partly the result of the ecumenical causes which he espoused; (4) he capitalized upon specialized interests or hobbies in his speaking; (5) Jones had a special interest in such matters as appearance and poise, vocal impressiveness, imagination, style, and delivery; (6) he believed that imaginative titles and carefully prepared introductions and conclusions contributed much to the over-all effectiveness of the speech; (7) selected poetry and carefully chosen illustrations were the two favorite forms of supporting materials which he both recommended and used; and (8) he believed that extemporaneous speaking, only possible through extensive preparation and writing, was the best form of speech presentation.

Justifiable critical observations directed against Jones concerned his dependence upon imagery, his fondness for embellished language, and his conscious attention to voice and action. In spite of these criticisms, Edgar DeWitt Jones was by and large highly regarded as an effective preacher and lecturer.

Microfilm \$3.30; Xerox \$11.50. 253 pages.

ZOOLOGY

A LIFE HISTORY STUDY OF THE
CALIFORNIA LEAF-NOSED BAT,
MACROTUS CALIFORNICUS.

(Order No. 61-2912)

Gordon Van Rensselaer Bradshaw, Ph.D.
University of Arizona, 1961

Supervisor: E. Lendell Cockrum

The California leaf-nosed bats (*Macrotus californicus*) utilize natural caves and abandoned mine tunnels in the Lower Sonoran Desert. During winter they move to deeper caves and longer mine tunnels, feeding only during the warmer, pre-midnight hours.

At Fortuna Mine, near Silverbell, Arizona, 890 *Macrotus* were banded during a two-year period. During March

and April the population built up (equally males and females), but during summer the females segregated into maternity colonies and the males dispersed into smaller groups. From August through October the two sexes reassembled. Only males were consistently present during the winter. During November a large influx of *Macrotus* occurred that is interpreted as a migration movement.

The population movements reflect the reproductive cycle since the males become reproductively active in July and remain so until October or November; the females are inseminated in September and October concurrent with ovulation. Embryonic development is slow until March, but the remaining gestational development is rapid, with birth occurring in June. This is not "delayed implantation," but is "delayed development," and represents the longest gestation period for a New World bat.

Maximum life expectancy is in excess of ten years.

Predaceous birds and carnivores take only a small toll. Although reported to be frugivorous, Macrotus normally feeds only on insects, probably on ground dwelling or resting insects. Microfilm \$2.75; Xerox \$5.20. 103 pages.

THE MICRO-DISTRIBUTION OF THE CADDISFLY LARVAE PYCNOPSYCHE LEPIDA (HAGEN) AND PYCNOPSYCHE GUTTIFER (WALKER) IN A RESTRICTED PORTION OF A SMALL MICHIGAN STREAM

(Order No. Mic 61-2742)

Kenneth William Cummins, Ph.D.
University of Michigan, 1961

A year-round study of the larvae of two species of limnephilid caddisflies in Fleming Creek, Washtenaw County, Michigan, involved integration of extensive field observations, qualitative collections, and quantitative bottom samples, with laboratory studies on substrate preference and case building behavior. The quantitative field samples were subjected to detailed laboratory analyses, including a new photographic technique in which color transparencies taken of the stream substrate were analyzed for particle size and organic material. Larvae of P. lepida and P. guttifer were distinguished through their seasonal life history, habitat, case type, food materials, and number of setae on the first abdominal sternite.

In P. lepida larvae, the subterminal instars and the non-burrowing portion of the terminal instar are characterized by concurrent changes in substrate selection, case type, and food materials. An increasing number of larvae migrate from marginal, slow-water, silt bottom habitats to gravel-pebble substrates in more central portions of the stream bed, shift from organic to mineral case construction, and change from detrital to periphytic feeding. By the end of the non-burrowing period, which lasts from about September to February, P. lepida larvae possess stereotyped cylindrical sand cases; the typical case form results partly from selection of 1 mm diameter particles. The full grown larvae remain burrowed in the substrate from about February until pupation at the surface in July, August, and September. During this non-feeding stage, selection of gravel-pebble habitats appears to be based wholly on the burrowing suitability of the substrate.

The larval life history of P. guttifer is less complex than that of P. lepida; P. guttifer larvae remain in slow-water marginal areas most of their lives and use organic materials in these habitats for food and for case construction. Young P. guttifer larvae first appear in December when most P. lepida larvae have migrated to gravel-pebble substrates. This migration prevents any extensive contact between larvae of the two species. Only during periods of very low water accompanied by heavy periphyton growth are P. guttifer larvae found outside the marginal regions. In May, the full grown P. guttifer larvae fasten their cases to sticks or cobbles in silty areas along the stream margin and remain inactive until pupation in September and October.

Microfilm \$2.75; Xerox \$7.80. 167 pages.

SOME FACTORS AFFECTING THE DISTRIBUTION OF SYMPATRIC SPECIES OF RATTLESNAKES (GENUS CROTALUS) IN ARIZONA

(Order No. Mic 61-2743)

Arthur Erle Dammann, Ph.D.
University of Michigan, 1961

The purpose of this study is to investigate a number of factors that are known or presumed to affect the distribution of organisms, and to relate these findings to an area where the presence of seven distinct species of rattlesnakes suggests the possibility of severe competition.

The study area is defined and described as an ecotone between mountain and desert. The snakes (atrox, cerastes, mitchelli, molossus, scutulatus, tigris, viridis) investigated in this study are described in terms of gross morphology, comparative ecology and geographical distribution.

The factors of body temperature as related to ecology, absorption and emission of radiant energy, the role of coloration, metabolic rates as related to temperature, water relationships, and locomotion were investigated. These data were incorporated with those already published for these same species as well as those for other pertinent situations.

The following general statements were strengthened and/or verified:

1. The same limiting factors are not of equal importance for each of the species. That is to say, factors such as those related to body temperature, color, metabolism, water balance and locomotion do not exert the same influences on each species regardless of their sympatry.
2. Any given factor from among those listed above does not necessarily operate as a limiting force along the entire periphery of the range of any species.
3. In terms of ability to invade a wide variety of habitats and maintain high population numbers in those habitats, all seven species do not appear to be equally successful in the study area nor perhaps throughout their entire range. That is, some species have very limited ecological amplitude and small populations. Some of the other species have large geographical and ecological ranges superimposed on these smaller ones. In general, the species with small ranges, small amplitude and small populations are highly specialized and limited to specific environments. They are almost literally "submerged" by the species which show greater generalization. It is a moot question as to which is apt to make out best in the future. Highly specialized species may be the only ones to survive if the apparent trend toward greater aridity continues in present day deserts.
4. There are species differences in response to the following relationships that dramatically affect the ecology of each species.
 - A. Critical and optimum temperature levels vary between species and are related to their metabolic rates and ecology.

- B. Thermoregulation is not achieved because of differences in color. All seven species respond to radiation in the same degree regardless of color. Conduction via the substrate is a more important thermoregulatory mechanism than color.
- C. Coloration is related to procrustis in all of the species. An evaluation of body color, substrate and habits strongly suggests this to be true.
- D. All seven species have integuments that are highly impermeable to radiation and water vapor. Preliminary measurements have shown that they lose only one-tenth as much evaporative water as the best desert-adapted rodents, and permit the penetration of only small amounts of radiation.
- E. Method of locomotion is the most important factor in the distribution of one species. Quantitative tests and field conditions substantiate this.

Finally, the pertinent factors are related in turn to the distribution of each of the seven species in whatever degree they are applicable.

Microfilm \$2.75; Xerox \$5.20. 105 pages.

TAXONOMY, ZOOGEOGRAPHY, AND
EVOLUTION OF THE INDO-AUSTRALIAN
SPECIES OF THE GENUS TERONIA
(HYMENOPTERA, ICHNEUMONIDAE).

(Order No. Mic 61-2756)

Virendra Kumar Gupta, Sc.D.
University of Michigan, 1961

All the described species of the genus Theronia from the Indo-Australian area are taxonomically assessed, new species and subspecies are described, and a detailed zoogeographical analysis of the range of each species and species group is made. The information thus derived is correlated with the geology of the area and attempts are made to explain the phylogenetic relationships of the species, their center of distribution, and probable mode of dispersal and evolution.

Of the forty-five previously described species only twenty are recognized as valid species, plus four that I have not been able to identify from their inadequate descriptions. The rest are their synonyms or subspecies, including several new synonymies. Thirty-three species are described as new, and the total number of species thus recognized from the Indo-Australian Region is fifty-seven. The total number of forms (species + subspecies) treated in the revision is eighty-eight.

The species of Theronia are grouped under five subgenera, of which four, Parema, Nomosphecia, Augerella, and Epitheronia, are described as new subgenera and are known only from the region of study. The fifth subgenus, Theronia, contains all the known synonyms of the genus Theronia and is world-wide in distribution. The subgenera show different morphologies of their ovipositor tip and mandible and have probably evolved as response to different host relationships. Many species of the subgenera

Theronia, Parema, and Nomosphecia are sympatric and show parallelism and convergence in color patterns in their respective ranges.

The Greater Sunda Islands, collectively called Sundaland, are considered to have been the main center of distribution of the genus. The occurrence of the most generalized members, a larger number of generalized species, and the divergence of evolutionary lines from that area suggest that species have radiated in different directions from this area.

The fauna of India and southern China was derived from stocks in Sundaland, which has further differentiated into Peninsular Indian, Himalayan, and Formosan faunas. Of these three faunas, that of Peninsular India is closest to the ancestral stock in Sundaland.

The fauna of the Philippines was also derived from that of Sundaland mostly along the Sulu Archipelago. A complex relationship of species occurring in the Philippines suggests that its fauna was derived at different intervals of time. The southern Philippine fauna is generally different from the northern Philippine fauna and is closer to the ancestral stocks.

There is no evidence that the fauna of Celebes was derived from Borneo across the Macassar Straits. On the contrary it is highly probable that Celebes received its fauna from Borneo by way of southern Philippines. Many species show such relationships.

The fauna of New Guinea and the Molucca Islands was derived from the Oriental Region, though the species have diverged considerably from their Oriental ancestors. New Guinea shows an admixture of Oriental stocks derived through Celebes, Oriental stocks not occurring on Celebes, a few species related to those of Australia, and some species of uncertain relationships. The fauna of Melanesian Islands is partly related to that of New Guinea and partly to that of Australia. Because of the peculiar faunal composition and its acting as a faunistic transitional zone, the Celebes-Melanesian area is recognized as a distinct zoogeographical region.

Radiation of Theronia took place mostly during Pleistocene times but some stocks must have diverged earlier. Southeast Asia arose above water during the Tertiary and since, which is also probably the time when the genus Theronia evolved.

The relationships of the species suggest that their dispersal was mostly along land connections during the Pleistocene owing to lowering of sea level. Whenever two islands have been connected in the geological history, their fauna is also similar and related. Islands situated close together (Borneo-Celebes) but not connected to each other during geological times show different faunal compositions. Over-water dispersal has been limited and has resulted in poorer faunas (Molucca Islands).

Microfilm \$4.95; Xerox \$17.55. 386 pages.

THE NATURAL HISTORY OF THE CAVE BAT, MYOTIS VELIFER.

(Order No. 61-2910)

Bruce Jolliffe Hayward, Ph.D.
University of Arizona, 1961

Supervisor: E. Lendell Cockrum

A natural history study was made of the populations of Myotis velifer (J. A. Allen) in the vicinity of Tucson, Arizona. The results have been grouped under the major headings of morphology, distribution, populations, activities, reproduction and development, food habits and behavior. Where applicable, natural history information from the literature was added to make the study more complete. Microfilm \$2.75; Xerox \$6.20. 127 pages.

CIRCULATING BLOOD VOLUMES IN THE LITTLE BROWN BAT (MYOTIS LUCIFUGUS LUCIFUGUS)

(Order No. Mic 61-2444)

Frank Clements Kallen, Ph.D.
Cornell University, 1961

Part 1: Vascular Changes related to hibernation in the Vespertilionid Bat Myotis lucifugus. A significant decrease in plasma volume during hibernation was found in the little brown bat, Myotis lucifugus, by using a modified Evans Blue dye dilution procedure. This decrease was not reflected in higher hematocrits or higher specific gravities of heart blood or plasma, which suggests a redistribution of cellular and plasma protein components of the blood during hibernation. A mobilization of blood cells in the thoracic circulation during arousal was suggested by the high mean hematocrit observed; dye studies indicated a preferential thoracic circulation at this time. Significantly higher hematocrits and plasma specific gravities were noted after arousal in bats which had been in relatively undisturbed hibernation, suggesting a dehydration. This was not true of bats which had recently been disturbed, and presumably had taken water while aroused. Bleeding, arousal from hibernation, or flight is accompanied by a significant shrinkage of the spleen. However, when bats have been at rest at 30° C for 4 to 5 hours, their spleens are as large as those found during hibernation. The spleen was found to contribute significantly to circulating cell volume upon arousal and appears to be the only organ which was doing so. However, the volume of cells in the spleen is inadequate to account for the extra cell volume implied by calculating cell volume from plasma volume and heart hematocrit when a constant F cells ratio is assumed. A higher concentration of cells in the peripheral circulation is suggested during hibernation, and the reverse during activity.

Part 2: Plasma and Blood Volumes in the Little Brown Bat. Modifications are described which make T-1824 suitable for plasma volume determinations on small bats. An average plasma volume of 6.5 ml/100 gm body weight has been determined for the active little brown bat,

Myotis lucifugus; average blood volume, based on plasma volume and hematocrit, is 13.0 ml/100 gm body weight. Seasonal changes have been observed, associated with fat deposition and with pregnancy. Young bats have a proportionately greater blood volume. Plasma and blood levels are changing least at the beginning and end of the hibernating period. Comparison with the results of other workers suggests that, while a plasma decrease and unchanged cell volume seem generally characteristic of mammals which have entered hibernation, a concurrent drop in heart blood hematocrit of the hibernating bat suggests a redistribution of erythrocytes as well.

Part 3: Summer Cr⁵¹ RBC Volumes in Little Brown Bats. A Cr⁵¹-labelling procedure is described for determining circulating erythrocyte (RBC) volumes in the little brown bat, Myotis lucifugus. Five minute mixing of labelled cells is 97% complete and remains so for up to 1 hour after injection, owing to RBC retention by the spleen.

From late pregnancy to post-lactation, active bats average 4.4 ml RBC/100 gm body weight. Blood volume calculated from RBC volume and previously determined plasma volume is 11.1 ml/100 gm body weight. The F cells ratio is .8. Blood sample % RBC drops during lactation. High cell volume is associated with high body weight only during post-lactation. RBC volume after lactation is significantly lower than that of term pregnancy. Some, but not all bats appear to have lower RBC volumes after delivery. No compensatory cell volume changes have been detected until lactation has ceased; lactation polycythemia is not indicated.

Five minute mixing appears less complete when lactating bats are placed in hibernation; such bats appear to approximate a condition of arousal rather than true hibernation. Previous studies are discussed.

Microfilm \$2.75; Xerox \$5.00. 99 pages.

THE EFFECTS OF CONTINUOUS GAMMA RADIATION ON THE INTRINSIC RATE OF NATURAL INCREASE OF DAPHNIA PULEX

(Order No. Mic 61-2774)

Jack Stanton Marshall, Ph.D.
University of Michigan, 1961

The main purpose of this research was to determine the effects of continuous sub-lethal gamma radiation on the intrinsic rate of natural increase, r, of Daphnia pulex. It was also intended to analyze the effects of radiation on the population attributes underlying r, namely, the birth rate, b, the death rate, d, and the stable age-distribution. It was mainly in view of the importance of r in theoretical and experimental population ecology (and population genetics) that this approach was taken in a study of the effects of ionizing radiation.

The stable age-distribution, as well as r, b, and d, were calculated from "life table data" (age-specific rates of survival, l_x, and fertility, m_x, throughout life) for each of 21 cohorts, or "populations," each of which was initiated with 50 newborn daphnids.

The life table data were obtained by daily census of the survivors and offspring. Reproduction was entirely by

parthenogenesis. All of the newborn, exoskeletons, and dead animals were removed daily, and the survivors were returned to a clean beaker containing fresh culture medium. The latter consisted of a suspension of Chlamydomonas reinhardi cells in aerated spring water.

The dose rate to which each "population" was exposed was determined with a Victoreen thimble chamber. Each of the 18 experimental populations was exposed to a different, continuous dose rate. These 18 dose rates covered the range from 25 to 75 roentgens per hour. Three additional populations, serving as controls, were exposed to only a fraction of a roentgen per hour.

The intrinsic rate of natural increase, r , decreased continuously as a non-linear function of the dose rate (although approximately a linear function of the square of the dose rate). At 70 roentgens per hour, r equaled zero, and at higher dose rates it was negative. The decrease in the value of r with increasing dose rate was due almost entirely to a falling birth rate, b , rather than an increasing death rate, d . The death rate was not detectably affected up to 45 roentgens per hour, but beyond this it began to rise abruptly. However, this was not a reflection of any "threshold" for life-span shortening; it was due to an increasing proportion of "older" individuals in the population. The effects of increasing dose rate on the stable age-distribution were mainly a decrease in the proportion of individuals in the youngest age groups and an increase in the proportion of "older" individuals. The proportion of individuals in the intermediate age classes were relatively unaffected.

Almost all of the results observed in the present study stem primarily from reductions in the age-specific fertility rates. These were inversely correlated with dose rate throughout reproductive life. This was due almost entirely to reduced fecundity rather than increased prenatal mortality. The over-all results indicated that the reduction of fecundity and fertility was due to direct effects of the radiation on the ovaries rather than to indirect, physiological effects. It was considered likely that dominant lethal chromosome aberrations were ultimately responsible.

Individual life expectancy at birth, or average life-span, was not greatly shortened by any of the dose rates employed in this study. Furthermore, age-specific survival rates were not affected until late in reproductive life.

Individual growth in length was determined by daily microscopic examinations of daphnids temporarily removed from the cultures. Individual growth in length increased with increasing dose rate. This was interpreted as mainly due to a saving of energy and matter which at lower dose rates was spent in egg production.

Possible ecological consequences of increased mutation rates and reduced intrinsic rates of natural increase were discussed, and the present results for Daphnia pulex were compared with related information obtained by other investigators for Drosophila melanogaster and other species.

Microfilm \$2.75; Xerox \$4.00. 74 pages.

AN ECOLOGICAL COMPARISON OF SIX BROWN TROUT (SALMO TRUTTA) POPULATIONS

(Order No. Mic 61-2386)

James Thompson McFadden, Ph.D.
The Pennsylvania State University, 1961

Estimates of population density for all species of fish except the slimy sculpin were made in sections of Cedar Run, Spring Creek, Spruce Creek, Young Woman's Creek, Kettle Creek and Shaver Creek in central and northern Pennsylvania. Electro-fishing gear and the simple mark and recapture technique were used in these estimates. The first three of these streams contain relatively fertile waters, with electrical conductivities of 281 to 412 reciprocal megohms, and the last three contain infertile waters, with conductivities of 36 to 43 reciprocal megohms. Total standing crops of fish ranged from 100 to 9600 individuals per acre and from 46 to 354 pounds per acre.

The brown trout populations of the six streams were studied more intensively than the other species. Standing crops of brown trout ranged from 13 to 137 pounds per acre. No consistent difference in brown trout density existed in hard and soft water streams. The ages of brown trout were determined from scale samples collected during population estimates. Survival rates were computed from the age structure of the brown trout populations. Average annual survival for age groups I to IV ranged from .189 to .554 and appeared to be related to intensity of exploitation of the populations. Variations in survival were not related to stream type. Considerable variation in recruitment of fingerling trout was noted in 1958 and 1959 and was believed to be related to flood conditions in some of the streams. Growth of brown trout was consistently greater in hard water than in soft water streams.

Collections of brown trout were made in the six streams intensively studied and in several additional streams of similar type in order to determine sex ratio, age at first sexual maturity and fecundity. Specimens were preserved and later dissected for these studies. The egg content of mature females was determined by direct count. Both hard water and soft water streams contained brown trout populations in which the sex ratio was 50 per cent females in all age groups. Observed deviations from this ratio were believed due to chance. Male fish first attained sexual maturity at an earlier average age than female fish. Brown trout matured earlier in life in hard water streams than in soft water streams, and a higher percentage of the larger fish of an age group matured than of the smaller fish.

Fecundity was expressed as the regression of number of mature eggs produced on total length of fish and the relationship proved to be logarithmic. Brown trout from hard water streams produced more eggs than those of a similar size from soft water streams except for one stream in which genetically fixed large egg size is believed to limit the number of eggs produced in spite of high fertility of the water. Fish of age groups II and III produced most of the eggs in these populations.

Growth rate of brown trout was significantly correlated with water conductivity. The data further suggested that a relationship may exist between water conductivity and pounds of fish per acre; and between water conductivity

and pounds of fish other than trout per acre when the effects of number of species present (which may be a correlate of water temperatures) are eliminated.

Ecological life tables and age specific fecundity rates were calculated for each brown trout population. From these the net reproduction rate (R_0) was calculated for each. These calculations indicated that each population had been essentially stationary in numbers in a net annual sense during the period covered by the data. The processes which held the populations stationary and some environmental factors which affect these population processes are discussed.

Microfilm \$2.75; Xerox \$4.80. 91 pages.

**PROBLEMS IN WOODCHUCK
POPULATION ECOLOGY AND
A PLAN FOR TELEMETRIC STUDY**

(Order No. Mic 61-2437)

Howard Gray Merriam, Ph.D.
Cornell University, 1960

Some vital statistics of a woodchuck (*Marmota monax rufescens*) population are difficult to obtain by existing methods. Marking woodchucks with radio transmitters and monitoring these telemetrically should improve estimates of population parameters.

Certain aspects of woodchuck population ecology and autecology were investigated to determine requirements for a monitoring system.

The distribution of dens fitted a negative binomial distribution. Almost all dens were in well drained soil and were more frequent on steeper slopes.

A spring population of 25 to 35 produced 29 to 40 young. Mortality losses from one litter were followed in detail.

Dispersal of juveniles was gradual until independence then saltatorial in some cases.

Woodchucks frequently move among five to eight dens during all seasons.

A small transmitter was developed for surgical insertion in woodchucks. A telemetric system was developed that is potentially capable of recording the identity (frequency) and location of all marked woodchucks in 50 dens once every five minutes.

Transmitters were inserted in 17 woodchucks which were released in field tests. Preliminary tests indicate that animals can be located and identified by this system. Tests and development are being continued.

Microfilm \$2.75; Xerox \$7.80. 169 pages.

**CAVE ADAPTATION IN
AMBLYOPSID FISHES**

(Order No. Mic 61-2787)

Thomas Layman Poulson, Ph.D.
University of Michigan, 1961

The purpose of this study is to a) characterize cave adaptation as represented by the five species of amblyopsid fish, and b) determine whether there are successive stages to cave adaptation. The species of the Amblyopsidae (Amblyopsoidea, Cyprinodontiformes or Percopsiformes) are uniquely suited to a study of cave adaptation since they represent surface-living, cave-spring, and cave-restricted forms on the interspecific level, and various degrees of cave colonization on an intraspecific level.

In the ECOLOGY section the evidence for an annual cycle in caves and an annual growth and reproductive cycle in amblyopsids is presented. In addition, the relation of cave ecology to adaptive changes in life history following cave-restriction is discussed. Analysis of DISTRIBUTION, GROWTH, and VARIATION shows that a) a combination of ease of dispersal through the watertable, habitat types, food supply, and degrees of isolation for local populations explains the lack of distinct clinal geographic variation in the various amblyopsids, and that b) present distribution depends on restriction of both species of *Amblyopsis* to caves above the watertable, ease of dispersal for each species, and possible competition between *Chologaster agassizi* and *Typhlichthys*. During studies of ACTIVITY AND METABOLISM, standard metabolism, routine metabolism, and active metabolism were measured. The values obtained were combined with those on activity levels in nature so that estimates of metabolism in nature could be made. In the section dealing with MORPHOLOGICAL CORRELATES OF BEHAVIOR the morphology of brain and sensory systems is described. The development of these systems is related to obstacle-avoidance, spatial memory, and feeding behavior.

This study shows that successive stages of cave adaptation are exemplified, in order, by *Chologaster cornutus*, *C. agassizi*, *Typhlichthys subterraneus*, *Amblyopsis spelaea*, and *A. rosae*. These stages are: 1). pre-adaptation; 2). endocrinological adjustment to permanent darkness; 3). reduction of pigment in addition to reduction and degeneration of structures associated with sight; 4). hypertrophy of equilibrium receptors and sensory receptors important for feeding and orientation; 5). stabilization of proportional changes of the preceding receptors; 6). lowered absolute growth and standard metabolic rates; 7). decreased fecundity and increased proportion of old to young animals resulting from longer life span and irregular reproduction; 8). increased egg size and developmental time; 9). decreased intra-population variability for eye and pigment reduction and increased genetic fixation of this reduction; 10). suppression of activity and lower routine metabolic rate; 11). better correlation of sensory stimuli in the central nervous system resulting in better prey and obstacle detection; 12). decreased intensity of reaction to disturbing stimuli.

This study shows that the sequence of cave adaptation documented for amblyopsid fishes can be generalized to include other cavefishes. The differences among all cavefishes are explained by length of isolation and thus by the

stage of cave-adaptation represented. Previously advanced hypotheses for cave-adaptation are not mutually exclusive since they merely concern different stages in the process.

Microfilm \$2.75; Xerox \$8.80. 191 pages.

PURIFICATION OF FOLLICLE STIMULATING HORMONE FROM ANTERIOR PITUITARY GLANDS OF THE HORSE

(Order No. 61-2980)

Brij Behari Saxena, Ph.D.
The University of Wisconsin, 1961

Supervisor: Professor W. H. McShan

The objective of this research was the development of a procedure for the purification of follicle stimulating hormone from horse pituitary glands and the possible isolation of this hormone. The procedures used for the purification are as follows.

Fresh horse pituitary glands were ground finely and extracted with 40 percent aqueous ethanol. The active material from the extract was precipitated by increasing the concentration of the alcohol to 85 percent by volume and recovered by drying with acetone.

This preparation was extracted with water at pH 5, adjusted to pH 7 and lyophilized. Seventeen of these extracts were prepared during this study and their average protein content was 11.3 mg as compared with 33.1 mg per g of fresh tissue for the above 40 percent ethanol extract. The FSH activity of the pH 5 extract was 184 percent of the standard as compared with 85 percent for the ethanol extract.

The pH 5 soluble preparation was used for the purification of FSH by zone electrophoresis on vertical columns using acid-alcohol treated cellulose as support with 0.05 M pH 7.7 phosphate buffer. Three active fractions were recovered from the first zone electrophoresis experiment one of which was predominantly FSH in action, another contained both FSH and LH activities and a third contained predominantly LH. The FSH fraction was further purified by second and third zone electrophoresis experiments using the same buffer since lower concentrations of buffer resulted in the loss of FSH activity.

The FSH fractions obtained during purification were filtered through cross-linked dextran gel (Sephadex G-25) to remove buffer salts and smaller organic molecules.

When the FSH fraction obtained after the third zone electrophoresis experiment was treated with Nuchar a considerable amount of pigment and LH was separated without much loss of FSH activity. The FSH fraction was resolved by vertical starch gel electrophoresis into 6 components. One of the components contained FSH activity which was recovered by secondary electrophoresis in a specially designed elution cell. This FSH fraction contained about 75 percent of soluble starch from the starch gel and was satisfactory for biological studies. When this preparation was run in an ultracentrifuge it sedimented as a single component. An end-group analysis also indicated one N-terminal residue. These results are very tentative due to the contamination of the preparation with the starch.

The preparation was assayed at the level of 5 g eq of fresh tissue in hypophysectomized male rats and the average weight of the ventral prostates was not increased over those of uninjected controls indicating the absence of LH activity. The ovaries from hypophysectomized female rats contained follicles and the uteri were distended with fluid indicating estrogen production. The FSH preparation was free of growth, lactogenic, thyrotropic and adrenocorticotropic hormones.

The soluble starch was separated from the FSH by chromatography on Dowex 2-X8. This resulted in a highly purified FSH preparation with 714 percent of the activity of the FSH standard obtained from National Institutes of Health.

A highly purified FSH has, therefore, been prepared from horse pituitary glands which is suitable for further biological characterization and for initial physical and chemical studies.

Microfilm \$2.75; Xerox \$4.80. 93 pages.

THE AVAILABILITY OF IRON AS A FACTOR LIMITING PRIMARY PRODUCTIVITY IN A MARL LAKE

(Order No. Mic 61-2791)

Claire LaVerne Schelske, Ph.D.
University of Michigan, 1961

An investigation was made of the factors limiting primary productivity in marl lakes. Blind Lake, a marl lake in Washtenaw County, Michigan, was studied most intensively during the period of investigation which extended from July 1957 to December 1959. The specific objectives of the study were to determine: (1) the influence of the physical and chemical characteristics of marl lakes on primary productivity, (2) the magnitude of primary productivity in Blind Lake, (3) the effects of nutrients and synthetic chelating agents on primary productivity and (4) the possible effect of chelating agents on the iron cycle of marl lakes.

Nutrients and synthetic chelating agents were added to lake water to study their effect on primary productivity. The responses of the natural phytoplankton populations were determined by measuring the rate of carbon-14 uptake by the phytoplankton in bottles incubated in the lake for periods of four to nine days. The advantages of employing lake water and its phytoplankton populations to study nutrients limiting primary productivity are discussed. The results indicated that iron was a limiting factor in Blind Lake, as well as in two other marl lakes, but was not limiting in a eutrophic lake. Three different forms of iron were used in experiments: ferric chloride, ferric citrate-citric acid and mono sodium ferric N-hydroxyethyl-enediaminetriacetate (NaFeEEDTA). All increased the rate of primary productivity. The form of iron is of ecological significance because ionic iron is insoluble whereas chelated iron is maintained in solution in alkaline oxygenated lake waters. The addition of NaFeEEDTA (chelated iron) to Blind Lake water increased primary productivity two to four times. The addition of NaFeEEDTA and nitrogen and phosphorus or Chu 10 nutrients to Blind Lake water increased primary productivity at least 30

times: Without NaFeEDTA, these two nutrient additions in some cases did not increase primary productivity significantly over the control.

Certain physical and chemical factors were studied throughout 1959, and in 1957 and 1958. These included water temperature, dissolved oxygen, total iron, pH, alkalinity and water transparency. Total iron in the surface waters during 1959 did not exceed 50 ppb. Because the lake basin is deep and well protected from wind action, aeration of the water mass during spring circulation in some years is incomplete due to the influence of hot, calm weather. In such years, a hypolimnetic oxygen deficit develops and the resulting anaerobic conditions cause iron to be released from the sediments. In years when iron is not regenerated from the sediments, the supply is dependent on that carried into the trophogenic waters by surface runoff. In such years a lack of iron may limit primary productivity.

The presence of the chelating agent, N-hydroxyethylene diamine triacetic acid (HEDTA), in jars containing mud and water influenced the exchange of iron between mud and water. Iron was released in less than four days from muds under aerobic conditions in the presence of HEDTA. This anaerobic release of iron occurred from both marl sediments and from highly organic sediments.

This study suggests two conclusions which may be made concerning chelating agents in natural waters: (1) the chelating role of dissolved organic matter in lakes may be studied by using synthetic chelating agents and (2) naturally occurring chelating agents have ecological significance in determining the fertility or productivity of waters.

Microfilm \$2.75; Xerox \$5.40. 108 pages.

CONTROL OF THE EUROPEAN CORN BORER WITH THE FUNGI, METARRHIZIUM ANISOPHIAE AND BEAUVERIA BASSIANA

(Order No. Mic 61-2272)

Omar Ewing Smith, Ph.D.
Iowa State University of Science and Technology, 1961

Supervisor: Tom A. Brindley

The purpose of this study was to compare the pathogenicity of the fungus Metarrhizium anisopliae (Metch.) Sor. with that of Beauveria bassiana (Bals.) Vuill. to the European corn borer. Because some insect populations have become increasingly resistant to insecticides, and because of the residue problem with some insecticides, field and laboratory evaluations of these fungi against the European corn borer were carried out.

The number of spores of M. anisopliae necessary to kill 50 percent of the larvae of the European corn borer in an injection experiment was found to be approximately 13.

The results of laboratory tests showed that first and second instar larvae were not affected by M. anisopliae, third and fourth instars were moderately affected, and that fifth instar larvae were severely affected by the disease. Reasons for this variation are not known, but may be due to the amount of the mold inhibitor present in the artificial medium.

pH determinations showed that after 72 hours the mean

pH of samples from 10 larvae injected with spores of M. anisopliae had changed significantly to 6.59 as compared to 6.46 for larvae injected with distilled water.

A study of the development of M. anisopliae showed that hyphal bodies were formed from infection hyphae which reproduce by budding at one or both ends. The hyphal bodies gave rise to the mycelium which filled the body cavity and penetrated through the integument to the outside.

Pupae of the corn borer were not readily susceptible by M. anisopliae. Moths treated with M. anisopliae were only moderately susceptible, whereas, all moths treated with B. bassiana died within five days.

In a first brood timing experiment in 1959 the results with both spray and granular formulations of M. anisopliae were poor, whereas, a reduction of 87.5 percent in the number of larvae was obtained with the granular formulation of B. bassiana applied on June 25. Nearly equal results were obtained with the spray formulation of B. bassiana applied on June 19.

In a timing experiment for control of second brood larvae in 1959 the reduction in the number of cavities with the spray formulation of M. anisopliae ranged from 3.1 to 19.7 percent, and a reduction of from 4.5 to 37.1 percent was obtained with the granular formulation. A reduction of 72.8 percent was obtained with the spray formulation of B. bassiana, and the granular formulation gave 59.1 percent control when applied on August 18.

In a timing experiment in 1960, employing formulations of M. anisopliae applied by high-clearance applicators, the control of first brood larvae ranged from 0 to 36.5 percent. Two and three applications failed to increase the percent reduction.

Single, double, and triple applications of spray and granular formulations of M. anisopliae and B. bassiana were made by hand for control of first brood larvae in 1960. A reduction of 84.9 percent in the number of cavities was obtained with three applications of the granular formulation of M. anisopliae. No cavities were found in the corn of the plots that received three applications of the granular formulation of B. bassiana.

From these experiments, it was found that the two fungi were equal in pathogenicity to corn borer larvae in the laboratory. In the field, however, M. anisopliae gave poorer results than did B. bassiana.

Microfilm \$2.75; Xerox \$4.80. 92 pages.

RESISTANCE OF BEANS (Phaseolus, Glycine max, Vigna sinensis, Vicia faba, and Dolichos lablab) TO THE MEXICAN BEAN BEETLE AND THE POTATO LEAFHOPPER.

(Order No. Mic 61-2859)

Dan Wolfenbarger, Ph.D.
The Ohio State University, 1961

Small field plots of beans were evaluated for resistance by using a visual rating of damage and counts of immature stages.

The objectives of these studies were to evaluate beans for sources of resistance to the Mexican bean beetle and potato leafhopper, compare methods of evaluation, and associate resistance with chemical or morphological

characters. Interspecific (resistant and susceptible species) *Phaseolus* crosses showed that resistance was recessive, and no segregates were noted in any generation. These investigations were conducted at Marietta and Wooster during the 1958-1960 seasons.

P. vulgaris PI 151014 and PI 173024 were considered resistant on the basis of mean nymphal infestations. Resistance was arbitrarily established at 0.4 or less nymphs per trifoliate leaf; intermediate resistance was established at 0.5-1.5 nymphs per trifoliate leaf. *P. vulgaris* PI 169731, PI 171799, PI 226938, PI 179402, Stringless Red Valentine, Idaho Refugee, Seminole, Sweetheart, Florida Belle, Cornelius 14, U. S. Refugee #5, Topcrop, Improved Supergreen, Stringless Blue Lake 231, and Puregold Wax lines were intermediate in resistance. The resistant and intermediate in resistance lines represented 1.7 per cent of the *P. vulgaris* lines evaluated. Hopperburn injury ratings were correlated with nymphal infestations; for each 1.68 nymphs a class, an increase of one was found relative to the leafhopper. Tolerance was found in the *P. vulgaris* lines.

Seven of nine other *Phaseolus* species evaluated were resistant to hopperburn. Only *P. acutifolius* and *P. coccineus* were susceptible to hopperburn and nymphal infestations, while *P. aureus*, *P. lunatus*, and *P. calcaratus* were intermediate in resistance to nymphal infestations. *V. faba* and *V. sinensis* were susceptible to nymphal infestations and hopperburn, while *D. lablab* was resistant to hopperburn but susceptible to nymphal infestations. Out of 10 pubescent types of soybeans, those classified as normal, sparse, semi-appressed, one appressed-hair variety, and dense were resistant to hopperburn. The glabrous and deciduous pubescent types were highly susceptible to hopperburn and nymphal infestations. Epidermal hair counts, made on 59 *P. vulgaris* lines, showed no relation to the nymphal infestation. Low calcium content in leaf tissue was associated with low nymphal infestation in *G. max* and *P. vulgaris* lines. Low nitrogen content in *G. max* was associated with high nymphal infestations. A low potassium content in *P. vulgaris* lines was associated with low nymphal infestations.

On the basis of mean leaf feeding damage ratings (based on classes 1 to 9 which describe percentage of leaf surface area damaged), *P. aureus*, *P. mungo*, *P. calcaratus*, *P. radiatus*, *P. atropurpureus*, *P. lathyroides*, *P. polystachyus*, *G. max*, *V. faba*, *D. lablab*, and *V. sinensis* lines exhibited varying degrees of resistance (classes of 1 to 3) to beetle feeding damage under field conditions. All *P. vulgaris* and *P. acutifolius* lines were susceptible (classes 7 to 9), whereas *P. lunatus* lines ranged from intermediate in resistance to susceptible. *P. lunatus* PI 194314 was the most resistant, while PI 180462, PI 183412, Early Thorogreen, Fordhook C2, PI 195344, and PI 195462 followed in an increasing order of susceptibility.

A significant correlation between larval populations and the leaf feeding damage ratings indicated a close relationship. A regression coefficient indicated that for every increase of 0.12 larvae per trifoliate leaf, a one-class increase in visual rating is noted. Since the leaf feeding ratings differentiate resistant from susceptible lines with less effort and time than would be required to count larvae, their use is recommended.

The various species which were resistant take longer to mature than the susceptible lines. Feeding preferences of the various genera were found in the bean beetle, whereas *P. lunatus* exhibited a tolerance to the feeding damage by the beetle.

Microfilm \$2.75; Xerox \$6.80. 145 pages.

The items following each abstract are: the price of a microfilm copy; the price of a copy enlarged by the Xerox process to 6 x 8½ inches; the number of pages in the manuscript. Please order copies by number.

A STUDY OF THE PHYSIOLOGICAL RESPONSES OF AMPHIBIAN MELANOPHORES

(Order No. Mic 61-2618)

Selma Blau Zimmerman, Ph.D.
New York University, 1958

Adviser: Dr. H. C. Dalton

Explanted amphibian pigment cells grown in an inorganic medium, Twitty's solution, were treated with hormonal and neurohumoral agents. The technique employed was that of retracting the original culture drop and replacing it immediately with a drop of the experimental solution. The cells were found capable of directly responding to these stimuli; the melanophores and xanthophores reacted to each agent in the same manner. An analysis of the in-vitro chromatophore response revealed that changes occurred in both the pigment granules and the cytoplasm and this resulted in an alteration of the pigment granule position and the shape of the cell.

Treatment of isolated pigment cells with epinephrine or norepinephrine, 7-11 days following explantation, resulted in a redistribution of pigment granules and a retraction of cytoplasm within the body and the branches of the cell. The response to epinephrine was effected more quickly than it was to norepinephrine.

Treatment of isolated pigment cells with acetylcholine or ACTH, 7-11 days following explantation, resulted in a redistribution of pigment granules and an extension of the cytoplasm within the body and the pseudopodia of the cell. When this treatment was applied to the more retracted pigment cells in tissue cultures of 13-19 days following explantation, the outward movements of the pigment granules and cytoplasm were very marked. The response to ACTH was more rapid than it was to acetylcholine.

The reactions of larval melanophores to the same hormonal and neurohumoral agents were observed by immersing intact *Ambystoma punctatum*, ranging from developmental stage 37 up to a larval length of 3.2 c.m., into the experimental solutions. Photographs of larval melanophores in successive states of dispersion and concentration showed that these different cellular conditions were achieved by changes in the cell boundary as well as in the pigment granule position.

The melanophores of larvae from developmental stages 37-44 were not capable of responding to epinephrine or norepinephrine. The melanophores of larvae of 1.7-3.0 cm. length were concentrated by epinephrine and by norepinephrine; the reaction became more rapid as development progressed.

Acetylcholine treatment of larval pigment cells resulted in a rapid dispersion of the melanophores especially during developmental stages 37-40. As development proceeded the responsiveness of these cells to acetylcholine decreased. This was probably due to an inactivation of acetylcholine by increasing amounts of cholinesterase. ACTH treatment of larval pigment cells resulted in a rapid dispersion of the melanophores.

The cellular responses of the in-vitro chromatophores to the agents used were like those of the in-vivo larval melanophores, insofar as both assumed a more concentrated state as a result of epinephrine or norepinephrine treatment and a more dispersed state as a result of acetylcholine or ACTH treatment. Furthermore, in both cases, such states of concentration and dispersion were achieved by changes in the position of the pigment granules and in the cell boundary. Microfilm \$2.75; Xerox \$4.40. 85 pages.

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